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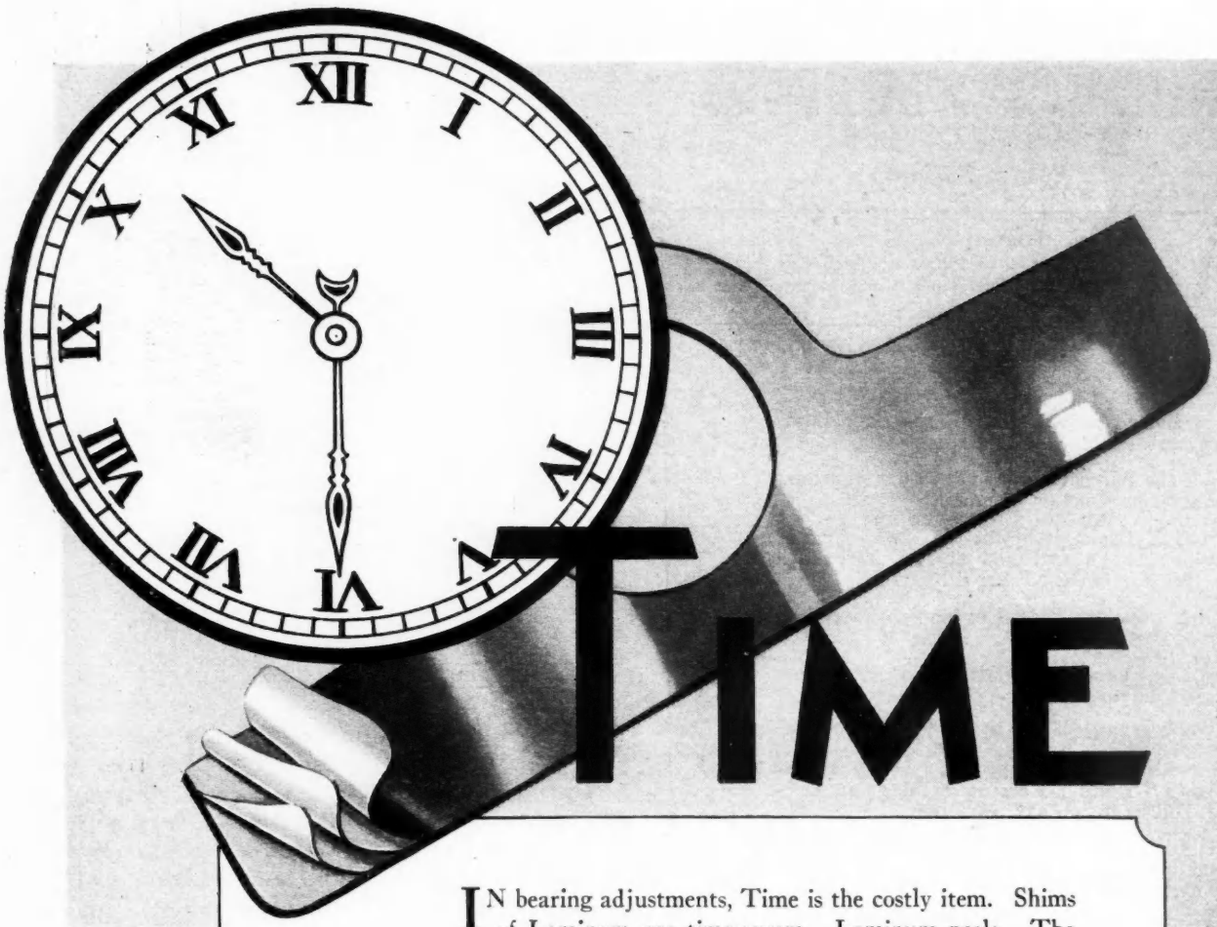

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AUTOMOTIVE INDUSTRIES
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European Tariff and Cartel *Plans* Face *Imminent* Defeat

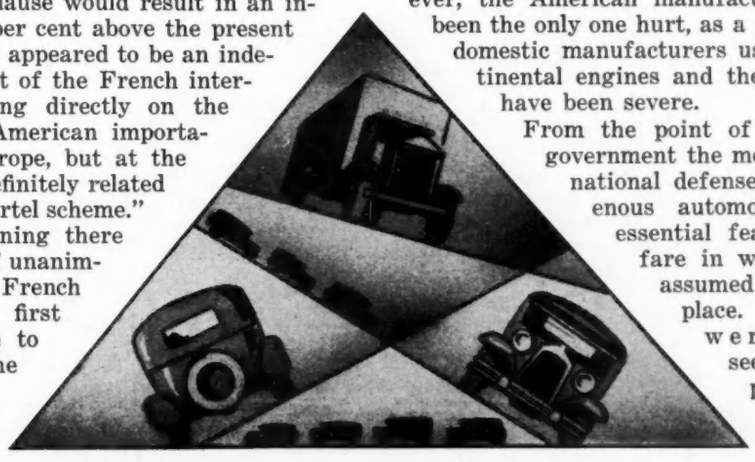
Disparagement of increased duties on automobiles in France and apparent failure of Continental makers to agree on new commercial treaties clear export situation.

By A. B. CROFOOT

RECENT developments in Europe pointing to a crystallization of much of the talk of the past few years about concentrated action on the part of European manufacturers to challenge the supremacy of American automobile manufacturers in their market, appear now rather to have died a-borning. When developments first started coming to a head at the time of the New York National Automobile Show, there was evident a lack of unanimity on the part of those backing the move which portended the defeat of the move, which defeat now seems imminent.

Specifically the agitation showed its first indication of crystallization with the introduction into the French Parliament of two measures designed to increase the tariff on automobiles, trucks and parts to a very marked degree. This move was represented by two separate bills, the first providing for an increase of duties on parts from 100 to 300 per cent of the existing schedules, and the other providing for an increase of duties on finished automobiles to 45 per cent ad valorem *or on weight*, whichever amounts to the most. The latter part was apparently a direct endeavor to exclude American cars, as they stand higher in weight per dollar value than other cars which are imported into France, and as the rates work out this clause would result in an increase of from 42 to 87 per cent above the present rates. This French move appeared to be an independent move on the part of the French interests and not one bearing directly on the broader effort to limit American importation to the whole of Europe, but at the same time it was quite definitely related to the much-discussed "cartel scheme."

From the very beginning there has been evident a lack of unanimity on the part of the French industry as far as the first bill was concerned, due to the fact that some of the largest domestic car manufacturers depend to a very large extent on American parts makers. Citroen, the largest of French manufacturers, with an output of approximately 100,000 units a year, is a large purchaser of American parts and would stand to lose heavily from an increase in duties on parts. While Peugeot would not be affected so vitally as Citroen, this company also buys much American material, and its influence probably fell on the conservative side of this particular measure. This group has just recently appeared before the tariff committee of the Chamber of Deputies and protested against the proposed increased tariff.



Renault is the leader of the opposite camp and is a powerful factor in the French market. Others of the larger manufacturers were largely lined up in the Renault camp, with the smaller manufacturers less clearly categoried. It seemed at first as if all the stronger elements of the industry would back that part of the bill increasing the tariff on engines and frames, which would have been a severe blow to Ford in all probability had it passed. Ford is the only American manufacturer maintaining an assembly plant in France. He sold approximately 8000 to 10,000 cars in France last year. Even had this part of the bill passed, however, the American manufacturer would not have been the only one hurt, as a number of the smaller domestic manufacturers use Lycoming and Continental engines and the blow to them would have been severe.

From the point of view of the French government the move was advanced as a national defense measure. An indigenous automotive industry is an essential feature in modern warfare in which motorization has assumed such an important place. When these two bills were introduced, they seemed to have the support of the government group in Parliament. More recently, how-

ever, *Le Temps*, the semi-official newspaper of Paris, has appeared to voice a certain amount of opposition to the passage of these two bills, from which fact American interests are taking heart in the belief that the government is not back of this move, at least for the present.

What brought this apparent change about is uncertain. The attitude of *Le Temps* was evident before the French manufacturers appeared before the committee to protest the passage of the bill, so it is not clear whether the Citroen group in the industry mustered a sufficient showing of strength among the left wing and uncertain elements of the Parliament to cause hesitation on the part of government or not. The existing government is, as have been all French governments since the war, a rather loosely knit coalition, and while a defeat in one attempt to block out American importation of automobiles would hardly call for a vote of confidence, it is unlikely that the government cares to jeopardize its position at all, particularly just now. International politics also plays its part. The existing government does not wish to take any action that would weaken its position in the London Disarmament Conference now in progress.

The Immediate Future

"ENGLISH automobile manufacturers seem not to have been parties to the Continental cartel agreements and plans as proposed by the French, although it is believed that some representatives sat in on the meetings at which the plans were discussed. Apparently they have adopted the policy of 'Let George Do It,' and sat back to watch developments as the others tried to put the plan in effect.

"With the apparent failure of the cartel proponents to agree, it appears that the American manufacturer has little to fear in the way of official interference in his export business with Europe in the immediate future."

The question of increased tariff on complete cars, while it seemed less likely to meet with domestic opposition than the other, was apparently held in abeyance, awaiting the reception of the parts tariff. International politics has doubtless also played a part in this measure as well as in the other.

The introduction of these two bills was noted with considerable alarm by American manufacturers who sell in France. Eighteen of them in Detroit drew up a protest which they forwarded to the United States Senate, and which was incorporated into the Congressional Record. A committee of importers in France was organized. This committee presented a protest to the tariff committee, pointing out that the prohibitive tariff proposed would result in keeping American cars entirely out of the market, and would result in a far greater loss to the income of the French government than would accrue to it by the sale of a correspondingly increased number of domestic cars. Furthermore, this committee pointed out, there would be a heavy loss to those employed in sales of American cars, or in the supplying of parts for such cars as are partially assembled in the country, which would offset any gain in employment in domestic plants.

Present indications are that these two bills will be forgotten in committee, for a while at least.

Incidentally, it must be borne in mind that any action taken by France affects not only the homeland but all of its colonies. This means that if the French tariff is raised to 90 per cent on finished cars, that will be the prevailing rate of duty on American cars imported into Algiers, Madagascar, Tunis, French Indo-China, French Guiana and other French colonies.

The broader question of the whole European market reaction was brought to the fore by the widespread discussion of the French moves, and it was announced in Germany that the manufacturers of France, Germany, Belgium, Italy, Austria and Czechoslovakia had entered into an agreement to attempt to establish set limits to the importation of automobiles into their respective countries. So far as is known, no definite proposal along these lines was made to American manufacturers, for their participation in such an agreement, but some efforts were evidently made to sound out some of them to ascertain whether they would become voluntary parties. In practice, this plan would work out in Germany, for example, with the establishment of a certain contingent of automobiles and automobile parts that could be imported from each manufacturing country at a minimum duty of about $18 per 220 lb. (75 marks per kilo). Everything imported over and above the contingent would be taxed at about $75 per 220 lb. (300 marks per kilo). This arrangement was to be reciprocal so that ostensibly there would be no injustice to manufacturers in any one country. Obviously, however, inasmuch as the United States sends more cars to any of these countries than they send here, and more than any other country is apt to send them, this was meant as a direct attack on the American business abroad.

Such a move would obviously require the framing of laws in these various countries setting up tariff schedules in accordance with the contingent agreement, and it is extremely doubtful whether sufficient unanimity could be procured from the various governments to make the enactment of the requisite uniform laws possible. It is understood that a part of the alleged agreement included the instigating of moves similar to that made by France as clubs to hold over the heads of the American manufacturers should they oppose the adoption of the contingent plan too strongly. It was undoubtedly the premature launching of the French tariff fight that precipitated the announcement of this cartel agreement.

Since the announcements of these agreements, however, the German government has declared itself unwilling to become party to any such a scheme, particularly as it would tend to upset certain commercial treaties now existing, specifically the one between Germany and Italy. In Belgium, one of the car manufacturers wrote an article advocating putting the plan into force, but it seems to have gone no further there. The Belgium government, so far as can be learned now, has completely ignored this suggestion and none of the other governments involved in the case have evinced any tendency to fall into the plan. Meanwhile, it is understood that the manufacturers themselves, who have been the leading advocates of the cartel plan, have more or less given up the idea because of lack of agreement among themselves. The English manufacturers seem not to have been parties to the agreement, although it is believed that some of them sat in on the meetings at which the plans were discussed. Apparently they have adopted

the policy of "Let George Do It," and sat back to watch developments as the others tried to put the plan into effect.

With *Le Temps* tending to disparage the increased tariff, and supposedly reflecting the government's attitude in this, with Germany officially refusing to sanction any change in the present scheme of things, with the rest of the European governments ignoring the question entirely and with apparent failure on the part of the cartel proponents to agree, it appears that the American manufacturer has little to fear in the way of official interference in its export business to Europe in the *immediate* future.

A careful observer of European affairs, Albin E. Johnson, wrote for the *New York World* last week: "The United States of Europe of political daydreamers is a wonderful idea, a sort of Utopian conception, which may, or may not, be within the realms of possibility. It has been toyed with by internationalists since before the World War, and today, needless to say, in its pure form is no nearer attainment than a decade ago. However, it has furnished the vehicle for Foreign Minister Briand's practical economic and political proposal, which if brought to consummation may eventually prove of incalculable good—or harm—to the commercial structure of the whole modern world.

"It is revealing no secret—even to those who have indulged in platitudinous oratory from the League rostrums to the contrary—to say that a European Customs combination has for its major objective the creation of a collective bargaining power which will enable European countries (those who dominate) to deal as a group, rather than independently, with the United States and other countries which now have decidedly the upper hand in the world's commerce.

"It is revealing no secret to say that a Europe-wide resentment against the existing American tariff and last summer's proposed tariff legislation had a great deal to do with the almost unanimous acceptance of Aristide Briand's project when it was launched in the preliminary conversations of last September.

"If Americans are inclined to think that the negotiations for a European Customs Truce which starts the middle of February are unimportant, they need only to look at the list of delegates and to be reminded that 26 out of 27 European states (all except Albania) were represented. And what is more significant is that many of them were represented by authoritative and responsible government officials as well as economic and industrial leaders.

"In 1927 the International Economic Conference drew delegations from two-score countries—men high in private financial, economic and commercial fields. But there were few if any delegates who spoke directly for the governments or who could pledge cabinets.

"The nations of Europe have learned one thing through the League during the past 10 years—the value of cooperation. They now know that while separately they may not fall, unitedly they certainly can stand. The old labor slogan of 'in union there is strength' has taken on a new meaning for them.

"Obviously, as Lucius Eastman, president of the New York Merchants Association, and a member of the League's Economic Committee, confessed, a rehabilitated Europe would be an asset to American business. Likewise it is obvious that so long as the 'most favored nation clauses' exist in practically every commercial treaty Washington has with European countries, any agreements made among themselves for mutual benefits would also accrue to the United States by virtue of these treaties.

"For example, France actually sells more to little Switzerland than to the big United States, although she buys heavily from America. Yet any concession France may choose to make to Switzerland, automatically is made to the United States, without any compensatory concession from the United States in return.

"Consequently, should the 26 European countries agree not to raise their tariffs against each other in a reciprocal arrangement, they would (assuming all have most favored nations' clauses in their treaties with the United States) be applying similar treatment to the United States if no action were taken to avert this contingency.

"The important thing to remember, however, is that America's commercial treaties are not perpetual. They are not unilateral as were the notorious Chinese trade treaties with the powers. And as soon as Europe has succeeded in cooperating just so soon will the United States be faced with treaty denunciations.

"The Customs Truce, for the moment, will be advantageous to the United States; a rehabilitated Europe under existing commercial treaties would be a boon to American export trade—but a rehabilitated Europe under an 'Economic Confederation' would be able to barter at least on even terms with an isolated United States—perhaps even impose its will upon American export trade if it were completely successful."

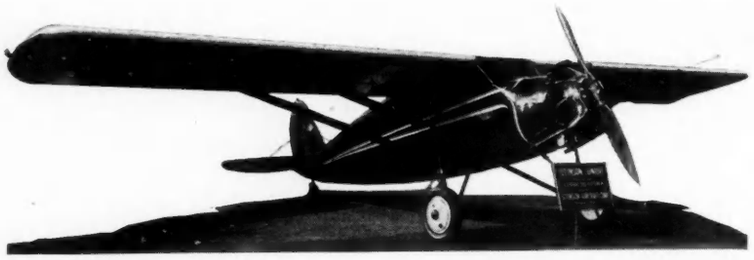
The possibility of any immediate coordination of tariff activities on the part of European nations seems to be remote in the face of national problems before these nations today. Even nationalistic policies over there fare none too well just now in the parliaments of continental Europe. Until parties in power are able to stand on national issues, until the opposition agrees on legislative measures which are confined within the borders of the important governments, there is little likelihood of any effective coalition of nations, in either a common tariff or any other program. The European nations are pro-European, not anti-American. But first of all, they are nationalistic in their interests. Experience down through the centuries has demonstrated that European nations will not cooperate with each other. Alliances for wars have been alliances of constantly-changing principles; treaties of peace have so frequently been between nations which were lately allies, that any united tariff alignment would be a reversal of the history of the nations.

A Distant View

"THE nations of Europe have learned one thing through the League during the last ten years—the value of cooperation," Albin E. Johnson pointed out last week in the New York World. "They now know that while separately they may not fall, unitedly they certainly can stand.

"The important thing to remember is that America's commercial treaties are not perpetual. They are not unilateral as were the notorious Chinese trade treaties with the powers. And as soon as Europe has succeeded in cooperating just so soon will the United States be faced with treaty denunciations."

Outlook for *Aircraft* Industry



Receiving a great amount of attention at the St. Louis show was this four-passenger Stinson Jr., powered with a Lycoming 210 hp. engine, due to its extremely low price of $5,775

Automobile dealers suggested as of airplanes at the Aeronau meetings. Monoplanes

By ATHEL F.

RADICALLY lower prices on a number of engines, resulting in rather startling price reductions of some lines of planes, probably were the outstanding feature of the International Aircraft Exposition. Arriving in St. Louis early last week, and facing the lower prices, increasing competition and an excess of production capacity over demand, executives in general seemed to be rather pessimistic regarding the outlook for the coming year.

The show week, with its good attendance at the show itself, the sale of quite a few planes from the floor, and the meetings of the Aeronautical Chamber of Commerce and other aeronautical organizations, however, did much to dispel the prevailing gloom. While one could hardly say that the average executive left St. Louis at the end of the week with expectations of a record-breaking year, there was more optimism evident.

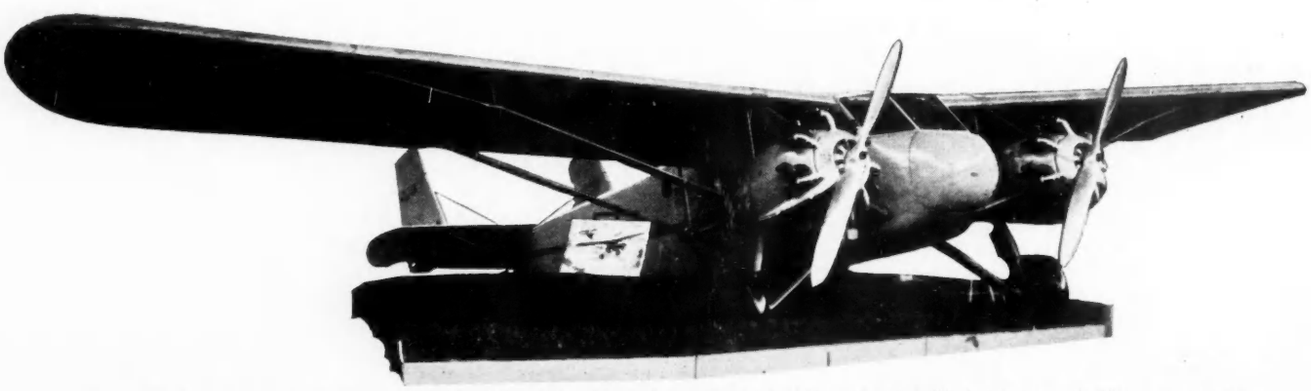
Outstanding of the problems which the industry is facing now are those of distribution and education. Both problems received considerable discussion at A. C. of C. meetings. Regarding the former, it was again suggested that automobile dealers are the logical outlet for retail airplane sales.

Aircraft operators feel that the reduction in rates recently put into effect on most lines, while resulting in tremendous increases in passengers carried, generally requiring two sections to be run, have failed to indicate a betterment of their financial condition. It is to be doubted that there will be a wholesale return to the higher rates, however, and operators are looking to the addition of express revenue, with increasing frequency and regularity of service, to provide the necessary return on their investment.

Production estimates for the coming year were exceedingly difficult to obtain from either airplane or engine manufacturers. The general tendency is to be conservative in those few cases where estimates were guessed at. The overproduction of airplanes last year, and the fact that production capacity is now about five times market requirements, are contributing factors. The latter is also the leading reason for the turning of many manufacturers to lower-priced fields in the hope of stimulating additional sales to prospective owners who are held back by prevailing high prices.

Lack of space prevents giving here a complete description of all the new planes exhibited at St. Louis. To mention just a few of them, Waco introduced a somewhat smaller 110-hp. Warner engine edition of their open cockpit ship, priced at $4,250. Curtiss exhibited a new two J-6-engined (450 hp.) plane called the Kingbird, an eight-place cabin ship with dual rudders and exceptional frontal visibility. It is priced at $24,700. Fairchild entered the low-horsepower open-cockpit manufacturing field with the Model K-21, a Kinner-engined training and sport plane, listing at $4,685. Great Lakes reduced the price on its training ship from around $5,000 to $3,150. Stinson set a new standard for four-place cabin ships, its Lycoming-engined plane of this type (210 hp.) listing at $5,775. Stinson also announced the forthcoming introduction of a three-motored transport.

Ryan had a four-passenger cabin plane also, powered with a J-6, and listing at $10,900. American Eagle's



Among the new planes was the Curtiss Kingbird, introduced by the Curtiss-Wright Co. It lists at $29,700 and is powered with two Wright J-6 engines of a total of 450 hp. It is an eight-place job

Improves at *International* Show

the logical outlet for retail sales tical Chamber of Commerce predominate exhibits.

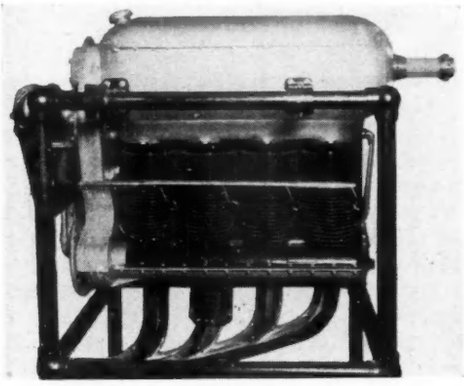
DENHAM

What is believed to be a new altitude record for light planes was set by a Barling NB-3 of the type shown here, during show week. Note the ski equipment

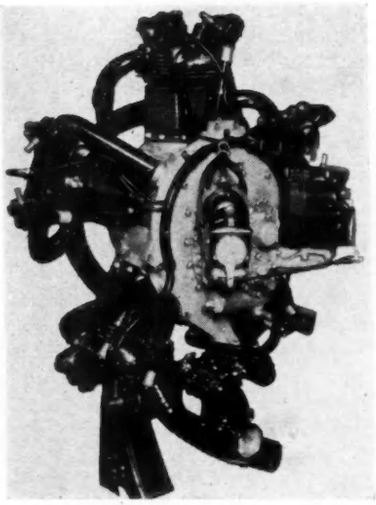
new four-place cabin plane, powered with a similar engine, lists at around $8,000. Aeronca had an interesting exhibit in the form of a powered glider, with semi-enclosed cockpit. Its engine develops around 30 hp.

The honors were evenly divided at the show between open-cockpit biplanes and closed-cabin monoplanes, although there were more open monoplanes shown than closed biplanes. Most of the monoplanes shown were of the high-wing type, although there were five examples of low-wing types, confined mainly to the open cockpit ships. Following are the rough percentages:

Monoplanes, closed cabin	38%
Monoplanes, open cockpit	14%
Biplanes, closed cabin	7%
Biplanes, open cockpit	38%
Total monoplanes	52%
Total biplanes	45%
Sesqui planes	3%



Another new engine was an inverted four-cylinder 90 hp. unit introduced by the Chevrolet Aircraft Corp. of Baltimore. Note the location of the exhaust ports and manifolding



Among the new engines introduced at St. Louis was the Warner "Scarab Jr." rated at around 85 hp. Its cylinder assemblies, gearcase, etc., are interchangeable with the seven-cylinder Scarab

Of the planes shown, again, 88 per cent were equipped with wheels, 5 per cent were amphibions, 4 per cent were float-equipped, while two ships were of the flying-boat type and were shown with ski equipment. Seventy-eight per cent of the ships had oleo or air or some combination of these types of shock absorbing mechanisms. Eight per cent used rubber compression and 14 per cent rubber in tension.

On 50 per cent provision was made for operation of the ship by either of two pilots, with dual controls. On 27 per cent optional dual control was not provided for, while the remainder represented planes on which it was clearly indicated that dual controls were optional.

From the noise point of view it was interesting to note that only 10 per cent of the engines in the planes were not equipped with either muffling stacks or exhaust collectors. Of the 90 per cent thus equipped, some 15 per cent had exhaust stacks and about 12 per cent had two exhaust collectors, one for each side (radial engines), with dual outlets. No actual muffler installations were to be noted, however.

Pneumatic-tired tail wheels in place of tail skids seem to be increasing in popularity, with about 37 per cent of the land planes thus equipped. There was also one example of a solid rubber-tired tail wheel, and one having a composition type tail wheel. Of the skid-equipped planes, 28 per cent had skids of the spring leaf laminated type, while the remainder had solid shoes with the shock taken up either by rubber or oleo mounting.

Interesting items also were the exhibition of five planes of four different makes with sheet metal cowling over the upper part of the landing wheels to provide better streamlining. On the Eastman flying boat a rudder is provided below the hull to facilitate handling of the craft on the surface of the water, working in conjunction with the main rudder. The new balloon wheels were in evidence on the American Eagle and Great Lakes Trainer. Dual rudders were found on two Curtiss ships, the Condor transport and the twin-engined Kingbird, the former having dual horizontal tail surfaces also. Seventy-one per cent of the land planes shown were equipped with brakes.

(Continued on page 379)

Relation Between Automobile and at Aeronautic *Meeting*

Instrumentation of planes and their ments, and all phases of powerplant at session. Ralph H. Upson

Roland Chilton, consulting engineer, Wright Aeronautical Corp., who asked for more cooperation from airplane manufacturers and operators in supplying information as to what was needed in the way of aircraft engines

THERE was hardly a phase of airplane engine design, manufacture and use which was not touched upon either in the papers or the discussion at the engine session which opened the S.A.E. aeronautical meeting in St. Louis. The two papers which aroused most interest at the session were one by Roland Chilton, consulting engineer, Wright Aeronautical Corp., on "Airplane Engine Development and Operating Reliability," and one by Robert Insley, vice-president, Continental Aircraft Engine Co., on "The Relation Between Automobile and Aircraft Engine Design." Mr. Insley did not confine himself to that topic, but also dealt with cost considerations in aircraft engine design.

Concrete suggestions as to remedies for existing troubles, improvement of design and performance, and reduction in cost, fuel consumption and weight, were made in the course of the session. It seemed that airplane engine manufacturers were about to drop the veil of secrecy and exchange ideas as to what might be done to improve aircraft engines as a whole.

Many of the suggestions made were reminiscent of developments in automobile engines during late years. Thus, the use of torsional vibration dampers was urged to prevent crankshaft failures and troubles with accessories due to excessive angular deflections of the free end of the crankshaft from which accessories are often driven. The use of vibration-damping clutches for the supercharger or gear-reduction drives is a related subject. Valve spring dampers for helical valve springs as used on some recent automobiles were suggested to reduce spring failures due to surge. Constant clearance lightweight pistons were advocated as worth consideration as a cure for oil pumping and other troubles. The opinion was expressed that mufflers will shortly be needed to reduce engine noises. Rubber-mounting of the engines also was recommended. Most of these suggestions emanated from Mr. Chilton's paper. Mr. Insley asserted that the use of unmachined connecting rods, crankshaft counterweights, etc., would materially reduce engine cost at the sacrifice of a little weight. W. F. Davis, G. D. Welte and Mr. Chilton agreed that a complete revision of present aircraft engine inspection methods was in order. As Mr. Welte put it, "Our present inspection methods and inspection specifications are due more to lack of knowledge of the requirements than to experience showing that such inspections are necessary."

Mr. Insley did not believe that enough could be saved by cheapening the quality of aircraft engine parts to make such a procedure advisable. "On a 150 hp. radial engine," he said, "we can save perhaps $200 by cheapening. On the other hand, we can save from $400 to $500 by doubling our production. The best plan to assure increased production is to maintain and improve quality, so as to increase the reliability of flying."

Mr. Insley amplified this further in his paper by stating that the higher cost of the airplane engine, in comparison with the automobile engine, could be explained in three words—weight, materials, quantity. Special production machinery for airplane engine parts is not justified except when essential to the production of the part itself. Moreover, in contrast to public assumption, engine tolerances are not as close in aircraft as in automobile engines, piston clearances being an example.

According to Mr. Chilton, the biggest problem confronting the engine designer who is striving for increased reliability is that of fatigue failures, especially those of somewhat indeterminate nature, as when harmonic vibration is a contributing factor. Other types of failure, Mr. Chilton said, can be eliminated through the acquisition of operating knowledge. For fatigue failures, which generally start from fine surface defects or scratches, some better method of inspection than at present available must be developed. The induction test already has solved this problem to a large extent for bar stock.

Vibration failures are particularly difficult to overcome correctly, Mr. Chilton pointed out. "Beefing up" a part that is consistently failing may cure the trouble, not by strengthening the part, but by raising its critical speed beyond the operating range. With proper application of the correct theory, it might be possible to achieve the same result by decreasing the weight, provided sufficient structural strength is retained. He illustrated this by referring to the relative strengths of an automobile crankshaft and a propeller shaft. The lighter propeller shaft transmits between three and four times the crankshaft torque without failure.

Mr. Chilton also voiced the need of manufacturers for cooperation from operators in supplying information

Aircraft Engine *Design Outlined of S. A. E.* in St. Louis

radio equipment, gasoline requirements, design and construction discussed as receives the Wright Medal.

Ralph H. Upson, to whom was presented the Wright Medal by the Society of Automotive Engineers for the best paper presented during the year on Aerodynamic Research or Airplane Design or Construction

as to the characteristics desired in aircraft engines. He asked for information on the following points among others:

Are front or rear exhaust collectors desired?

How far should development be carried with the N.A.C.A. cowling and its modification, the Townsend ring? Should these include the exhaust collector?

If an increase of say 0.5 lb. per hp. would result in a reduction of forced landings due to engine troubles in the proportion of 3 to 1, would operators consider the increased safety to justify the added weight?

Instruments for Flight Tests

INSTRUMENTATION for flight testing of airplanes and for blind flying was the subject presented at the Wednesday afternoon session, with C. H. Colvin, Pioneer Instrument Co., presiding. The first topic (flight testing) was covered by J. B. Peterson and E. W. Rounds of the Bureau of Standards, and the second, under the title of "Fog Flying," was discussed by Lieutenant James Doolittle, formerly of the U. S. Army Air Corps, and now with the Shell Petroleum Co.

Messrs. Peterson and Rounds' paper dealt in detail with the various instruments used for flight testing, methods of calibration, etc. Suggestions made by the authors included the following: Use low-temperature oil and graphite mixture in place of the usual oil in barographs where the instrument is to be used at low temperatures. Suspend the barograph from shock absorber cord to insulate it against mechanical vibration. In measuring air speed where there is a wind component perpendicular to the course selected, the plane should be flown with its axis parallel to the course itself, allowing the wind to drift the plane. The speed course method should not be used for the lowest point at or near the stalling speed, on account of dangers involved. Tachometers require the most frequent laboratory checks of all the instruments.

The authors also expressed the hope that a satisfactory fuel flow meter would be developed as the present method of measuring the fuel before and after the test run is unsatisfactory. It was also brought out that recording speed indicators were not as yet commercially available.

Lieutenant Doolittle's paper dealt largely with the equipment and results used and obtained in connection with the recent Guggenheim Fund blind flying trials. In addition to the usual instruments, the plane was equipped with a Kollsman barometric altimeter graduated in 10-ft. units up to 20,000 ft., a Sperry artificial horizon and a Sperry directional gyroscope. The sensitive altimeter was kept in adjustment by two-way radio communication with the ground. While the accuracy of the directional gyroscope seemed to be affected by long flights, its advantages make it preferable to all other directional instruments, since it is not affected by rough air and its precessional error is so small that only an occasional check against the compass is required.

Radio equipment included a R.F.L. standard aircraft receiver, and a vibrating-reed indicator, ground equipment including an army-type oral (spark) beacon, a visual (reed) localizer beacon, and a ground receiving and transmitting set. Wing tip antennae were found preferable to trailing antennae, due to the inconvenience of reeling the latter in, when approaching the field for a landing. Its disadvantages are that it has a shorter range and requires a short wave length.

Lieutenant Doolittle said hundreds of blind landings were made with this equipment without any breakage, thus clearly demonstrating that it is possible to provide instrumentation for complete commercial blind flying. The next step would be to have some commercial agency take up this problem and reduce it to a commercial scale.

In the discussion of the paper Lieutenant Doolittle also stated that the Sperry artificial horizon is effective up to 80-deg. banks, and 40 to 45-deg. pitch.

Gasoline Requirements

TWO papers by members of the Bureau of Standards staff featured the Fuel Session, H. K. Cummings' paper on "Gasoline Requirements for Commercial Aircraft Engines," and a paper by O. C. Bridgeman and H. S. White on the "Vapor Locking Tendency of Aviation Gasolines." Both papers gave evidence that pure research has greatly outstripped practice in this particular line, offering subject matter which the commercial aeronautical industry is as yet unable to apply in

Kenneth M. Lane, aeronautical technical adviser to the Department of Commerce, who was the main speaker at the banquet session of the S.A.E. and Aeronautical Chamber of Commerce

practice.

As an example of the possibilities in aircraft engines, B. Adams, Wright Aeronautical Corp., stated that by employing higher compressions, dependent upon the use of special fuels, or by the adoption of superchargers, they could provide operators with a 20 per cent increase in power, and with a 5 per cent drop from this figure, achieve fuel economies in the neighborhood of 0.41 lb. per hp. per hr., the latter with fuels having approximately 60 per cent Benzol content. Mr. Adams also stated that the Air Service is expected to go to a standard service compression ratio of 6 to 1.

Referring to Mr. Bridgeman's paper, Mr. Adams stated that during the past year he had run into only two cases of vapor lock, one due to a too-complicated fuel system, and the other due to the fact that the fuel feed line was too small to handle the necessary fuel. Mr. Bridgeman himself summarized some of the points brought out in the discussion, which dealt largely with the preponderant effect of the fuel system itself on vapor-locking tendencies:

1. Eliminate all sharp bends in the fuel lines.
2. Double the size of the tubing over that apparently required.
3. Keep the fuel lines as cool as possible.
4. Do not insulate the fuel tanks against heat transfer.
5. Place the fuel pump as low as possible. If flexible drive is available it should preferably be located below the lowest fuel level.

Upson Receives Wright Medal

"DEFECTS OF MODERN AIRCRAFT" was the topic of an address by Kenneth M. Lane, of the Department of Commerce, at the dinner meeting of the S.A.E. and the Aeronautical Chamber of Commerce. Mr. Lane emphasized that the Department of Commerce requirements which relate mainly to stress analysis figures, are merely a starting point to cover the minimum necessities, and that to be successful, manufacturers should not only exceed these requirements but take the initiative in other directions also. Of the major defects special emphasis was placed on the following:

Parts subject to wear and deterioration need careful watching in the design. Department tests are made on new ships only and therefore can only guess at the service reliability.

Stress analysis is often still poorly applied, especially in the case of landing gears.

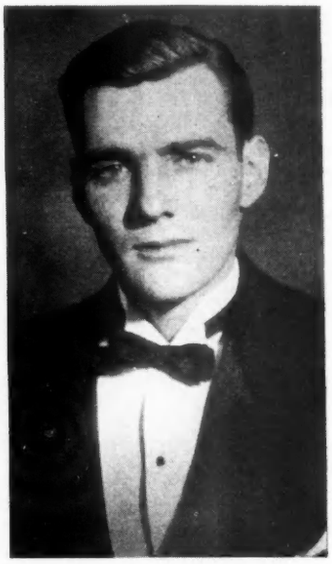
Aerodynamic improvements have lagged behind structural ones, the latter giving very little trouble nowadays. Especially important in this respect is the need for adequate slow speed control, and the elimination of chances of putting the airplane into a spin. Airplanes are more shy of lateral than longitudinal or directional control. Location of the stick often does not permit adequate movement in the cockpit.

Airplanes are too noisy. Vibration and drumming effects need correction. Propeller noises need reducing, probably by lower tip speeds. According to recent tests air sickness may be induced by high-pitched whistles from streamline wires and braces, etc.

Ventilation needs improving.

Fire hazards still remain one of the biggest problems.

Lighter cabin fittings, upholstery, etc., are needed.



Herbert Hoover, Jr., radio engineer, Western Air Express, and son of the President, who said that the government would soon require radio equipment on all transport planes

Honesty in advertising leaves much to be desired. Some unbiased agency should be developed which can certify to performance characteristics.

Charles L. Lawrance, who acted as toastmaster, advised manufacturers to take advantage of the present lull in the aircraft manufacturing industry to concentrate on research and development of new models and types.

During this session, the Wright Medal was presented by Dr. G. W. Lewis of the N.A.C.A., to Ralph H. Upson, consulting engineer, for his work in designing the Mc-2 Metalclad airship and his paper "Wings—A Coordinated System of Basic Design," which was presented at the last aeronautical meeting of the S.A.E.

Factory Profit Low

"THE average manufacturer of commercial airplanes today has only 20 per cent of the list price of the machine to allocate to labor, overhead, and profit; and in case the overhead rises much above 100 per cent (based on productive labor cost) the profit is pretty sure to disappear." This rather startling statement was made by William B. Robertson, president, Curtiss-Robertson Airplane Mfg. Co., at the production session of the S.A.E.

Mr. Robertson divided the list price of an airplane with a new production engine approximately as follows:

Sales discount	25%
Engine, cost to manufacture	30%
Material, other than engine, cost to manufacture	20%
Miscellaneous, royalties, development, etc.	5%
Labor	8%
Overhead	7%
Profit	5%

The percentage assigned to factory profit is extremely low, especially when it is remembered that in the automobile industry, the factory profit of a well-managed company runs around 14 per cent, with a much larger turnover of capital investment.

Mr. Robertson predicted that in future airplanes would be built for stock rather than to customers' orders.

(*Continued on page 373*)

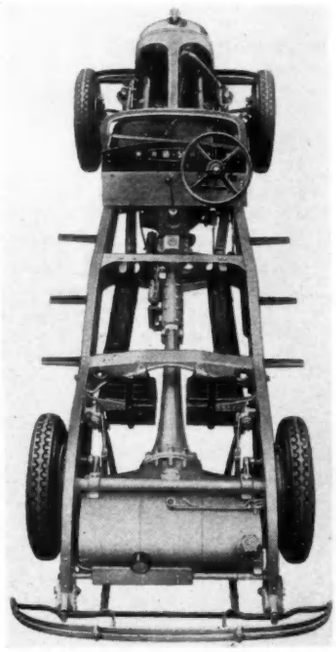
Maybach Develops *V-12 Engine* for *Passenger* Cars

German vehicle has powerplant with cylinder banks and top half of crankcase made in single aluminum alloy casting. Unit has vacuum-shift overgear and auxiliary fuel pump.

By EDWIN P. A. HEINZE

AFTER the introduction of 12-cylinder cars in Great Britain (Daimler) and France (Voisin), Germany now follows with a model of this type by the Maybach Motor Manufacturing Co. of Friedrichshafen. The most interesting part of the car is the engine, which, however, is a straight forward design based on the plan of the engines built by the company for use on Zeppelins. The chief advantage claimed for the 12-cylinder engine is its high degree of flexibility which makes it possible to drive the car on top gear anywhere except on very steep grades.

Both banks of six cylinders and the top half of the crankcase are made in a single casting of aluminum alloy, the two banks being offset longitudinally a distance equal to the length of the connecting rod big-end bearing. Cast-iron liners are inserted in the cylinders, and the cylinder heads, which contain the valve seats, are also of cast iron. Both heads are identical and therefore interchangeable. The valves of each bank of cylinders are arranged in line and are operated from a camshaft in the crankcase vertically over the crankshaft by means of pushrods and rocker arms.



Chassis of the Maybach V-12 car

The cylinder bore is 3.38 in. and the stroke 3.94 in. (422 cu. in.). With a compression ratio of 5.6 to 1, the engine delivers 150 hp. at 2800 r.p.m., and the car is said to be capable of a speed of practically 90 m.p.h. The crankshaft is of the eight-bearing type and two connecting rods are mounted side by side on each crankpin. Whereas roller bearings of a special design are used on the crankshaft of the aircraft engine, plain babbitt-lined bearings are used in this case. Main bearings are 2.95 in. in diameter. The rear bearing is provided with thrust flanges to take the end thrust. Between the two bearings at the flywheel end a helical pinion is mounted on the crankshaft, which meshes with a fabric gear on the camshaft. All main bearings and all crankpins are bored out to a comparatively large diameter, and the bores closed by means of disks with taper seats which are drawn tight against

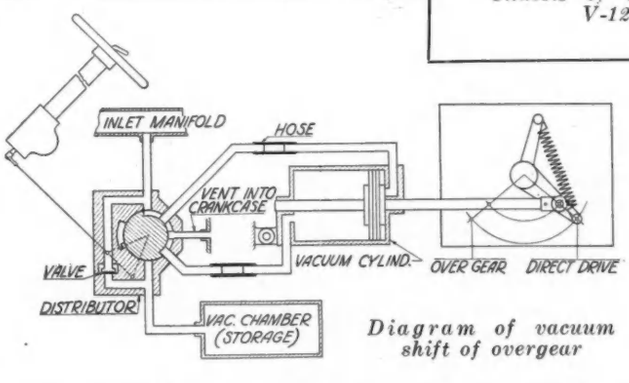


Diagram of vacuum shift of overgear

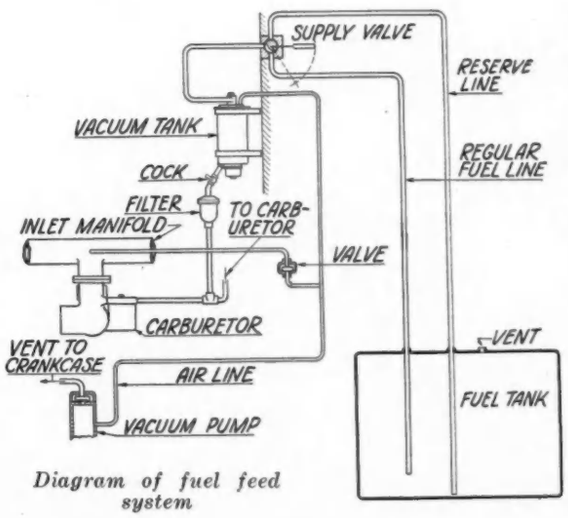
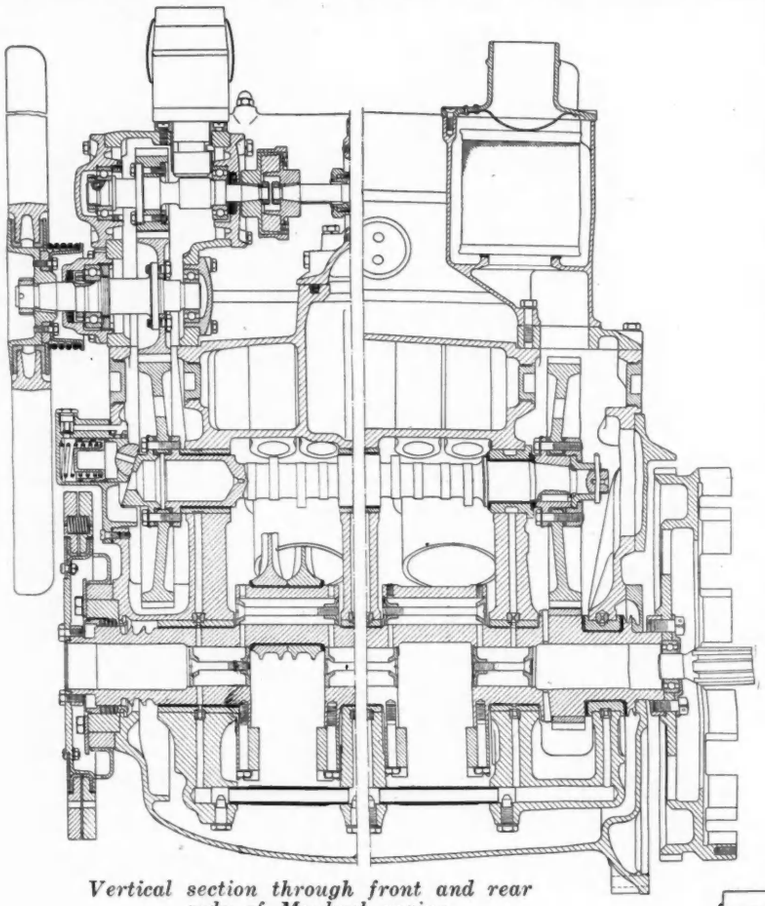


Diagram of fuel feed system



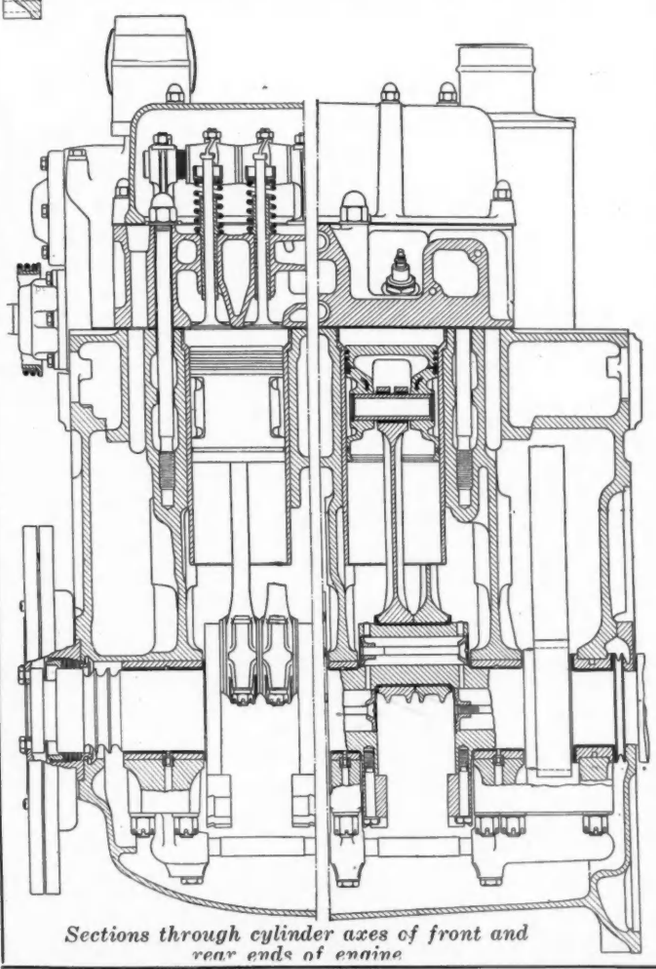
Vertical section through front and rear ends of Maybach engine

The camshaft, which has a diameter of 1.92 in., is supported in seven babbitted bearings. A helical gear for the oil pump drive is cut at the middle of the center bearing, the oil pump being located in a pocket of the oil sump on the left-hand side. End thrust on the camshaft is taken up on the flanges of the bearing at the flywheel end.

The oil pump forms a unit with the oil strainer and its mounting bracket, this unit being held in place by a number of cap screws and can be removed as a whole. A safety valve is provided which assures that sufficient oil for lubrication will get into the distributing line even if the filter should become clogged. Lubrication is entirely automatic, and no indicating device is provided on the instrument board or elsewhere. The distributing header is unusually sturdy, being substantially 11/16 in. in outside diameter. Oil is delivered under pressure to all crankshaft and camshaft bearings, while the piston pin bearings, which are of the floating type, are lubricated by spray. An oil filter is located on the left side of the sump, symmetrical with an oil gage on the right side.

their seats by means of clamp bolts. The bores in the main journals and the crankpins communicate through drill holes in the crank arms, and in operation all interior spaces of the crankshaft are filled with oil. It is noted that the crank arms are of disk type and that a counterweight is bolted to each. A Lanchester vibration damper is fitted to the crankshaft at its forward end. Pistons are of the Nelson Bohnalite type.

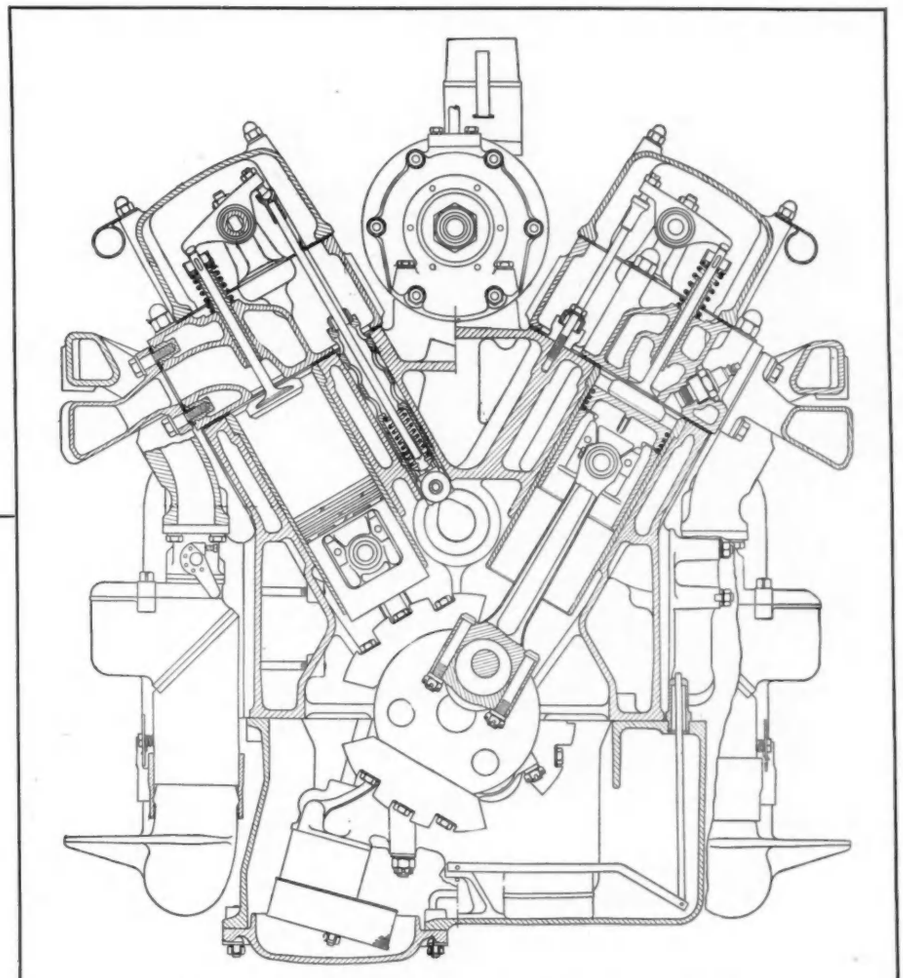
The camshaft is provided with a flange at its forward end to which a gear for the accessories drive is bolted. It is inserted through an opening in the forward end of the crankcase over which a small vacuum pump is bolted. The vacuum pump is mounted eccentrically with respect to the camshaft and is operated from it through a cap over the fabric accessories driving gear, which has a slanting face and contacts with a hemisphere in a socket in the end of the pump plunger. The pump plunger being eccentric with relation to the camshaft, a reciprocating motion is imparted to it by the rotation of the latter. The fabric gear on the forward end of the camshaft meshes with a metal gear on the fan shaft, which is mounted in two annular ball bearings. The metal fanshaft gear meshes with another fabric gear on the accessories driveshaft, from which the ignition unit for the right bank of cylinders is driven by a pair of helical gears. From its rear end this shaft drives the water pump, the generator and the ignition unit for the left bank of cylinders.



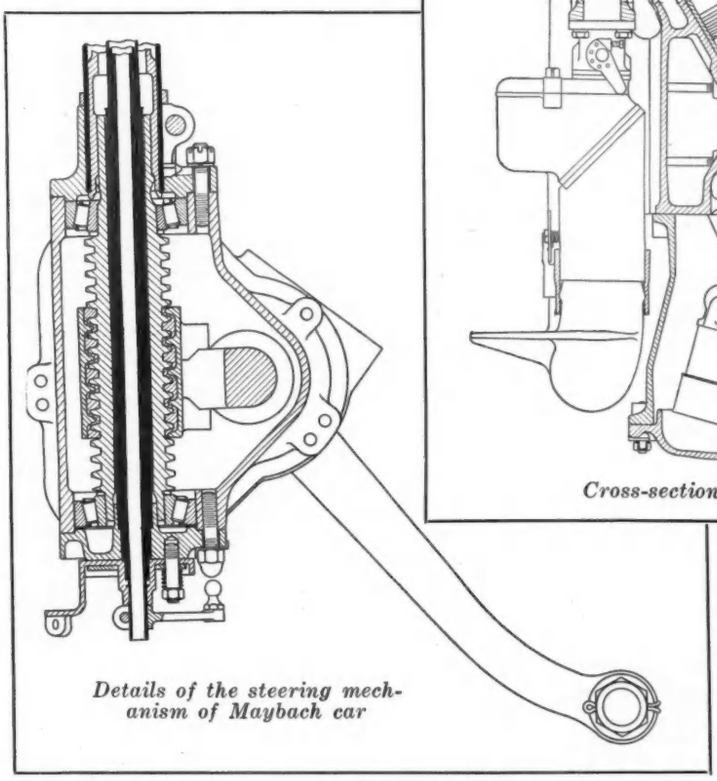
Sections through cylinder axes of front and rear ends of engine

All of the valve mechanism is fully enclosed within the V of the engine. The valves have a clear diameter of 1.37 in. and the lift is 0.31 in. Long valve-stem guides are used, and the push-rods are provided with roller-type cam followers.

Single battery ignition is employed. On the six-cylinder Maybach automobile engine dual ignition is used, but the cylinders of the twelve are so much smaller that the advantages to be gained by dual ignition were not considered worth while in this case. Two 12-volt batteries are provided, with a combined capacity of 140 amp.-hr., and are carried in a battery box supported from a cross-member of the frame at the forward end of the rear springs. The starter is bolted to the crankcase on the left side. Ignition timing is full-automatic, but a timing button is provided on the instrument board by means of which the ignition can be retarded in the event that fuels have to be used which will not stand the high compression.



Cross-section through Maybach 12-cylinder engine



Details of the steering mechanism of Maybach car

A double Solex carburetor is used for each cylinder bank. Air is drawn in through ports in the crankcase. A funnel is provided at the forward end of the crankcase on each side, through which the air enters the crankcase, being cleaned by an oil-saturated filter on the way. A channel is cast on each side of the crankcase through which some of the air required enters the carburetor directly without passing through the crankcase. The inlet manifold lies on top of the exhaust manifold, but is separated from it by a layer of asbestos and a strip of sheet metal.

Fuel is supplied to the carburetors from a rear tank of 36 gal. capacity by means of a vacuum feed system. There are two fuel lines from the main tank to the vacuum tank, as shown in the diagram reproduced herewith, one of the tubes extending all the way to the bottom and the other to such a depth that when the fuel level sinks below it there is still about 5 gal. left in the tank. Normally the fuel flows from the main tank to the vacuum tank through this latter tube. When this fails to supply fuel, the driver turns a handle on the instrument board controlling a two-way valve, which makes the reserve supply available. As with the throttle wide open, the manifold suction may not be sufficient to supply all of the fuel required, a small auxiliary vacuum pump has been developed and is driven from the forward end of the camshaft as already described. To facilitate starting in cold weather, a small fuel injection pump is provided on the instrument board. A control rod connecting the throttles of the two carburetors passes through the crankcase.

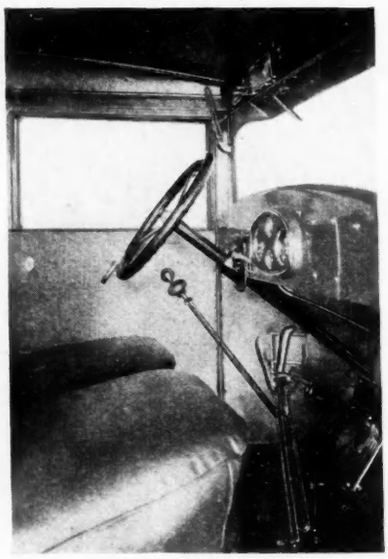
Engine, single-plate clutch and three-speed gearbox are combined in a single unit. A small air pump is mounted at the rear end of the gearbox and can be readily engaged by operating a small lever. The propeller shaft is enclosed in a cast-aluminum torque tube, on which both the driving thrust and the torque reaction are taken up. It ends at the transmission in a spherical joint containing a universal joint.

The Maybach overspeed gear is incorporated in the torque tube. It is operated by a vacuum servo, compris-

(Continued on page 377)

Eleven Basic *Chassis Models* in *Line* for This *Year*

Five new units are included. Variations in wheelbase and equipment number of types up to total of 118. Policy of unification adopted.

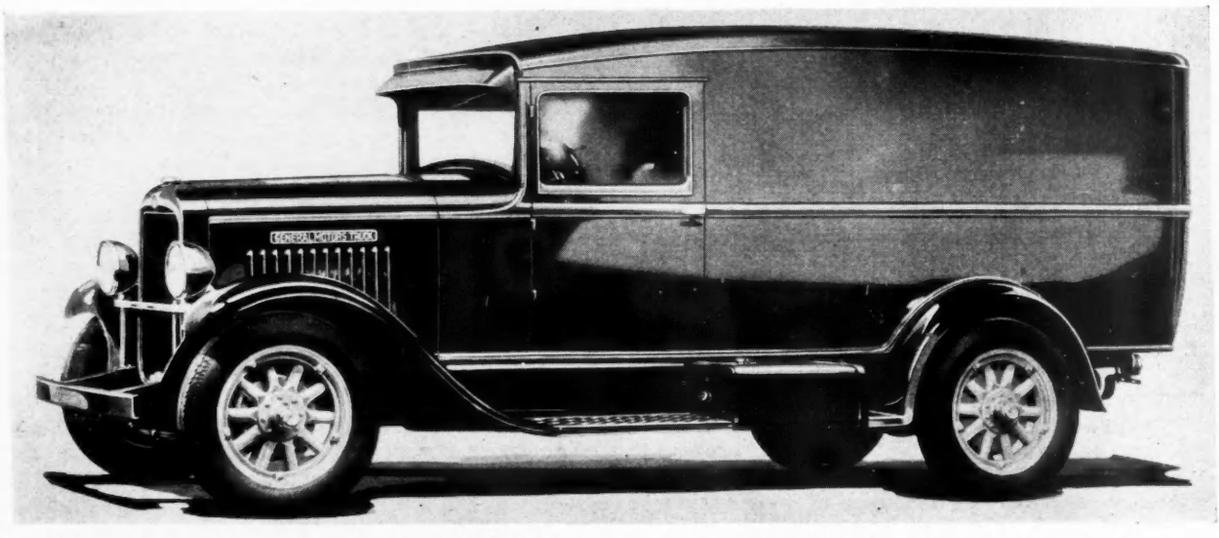


General Motors Truck de luxe cab, which follows closely the design of passenger car coupe bodies

ELEVEN basic chassis models completely covering the capacity range of from ½ ton to 15 tons are included in the 1930 program of the General Motors Truck Co., Pontiac, Mich. By varying the wheelbases of these basic chassis, a total of 33 different models is obtained, and variations in tire equipment, etc., give a total of 118 different types of truck. Six of the basic chassis models are continued with improvements. The remaining five being new. The new models roughly cover the ¾, 1, 1½, 3 and 5-ton ranges. To permit of producing so wide a variety of trucks economically, a policy of unification was adopted whereby the same chassis units are used in several of the basic chassis.

The straight rating adopted by G. M. T. last year is continued in principle but has been modified to some extent as the result of operating experience. The eleven basic truck models have a definite gross weight rating, as previously. With smaller tires or where single wheels are used instead of duals, the straight rating is correspondingly reduced.

While no drastic changes have been made in G. M. T. trucks as compared with last year, improvements have been made in various details. Front ends have been materially improved in appearance. Both the standard and the de luxe cabs closely follow passenger-car coupe bodies in their dimensions and have narrow windshield pillars, ventilating windshield passages back of the instrument board, cadet vizors and air holes in the seat cushions. Temperature indicators are provided on medium and heavy-duty trucks. Steering posts are adjustable; windshields swing outward, and on the medium and heavy-duty models the instrument panels are indirectly lighted. The frames of the cabs are of hardwood and steel. To prevent excessive stresses due to frame distortion the cabs are mounted at three points.



Model T-15 of General Motors Truck line which has a straight rating of 5400 lb., equivalent to about 1500 lb. pay load

General Motors Truck Company

In accordance with the general policy of unification, the cabs are made interchangeable on all chassis from the T-15 (¾ ton) to the T-90 (5-7½ ton). The only model on which the standard cab does not fit is the T-11, the ½-ton delivery unit.

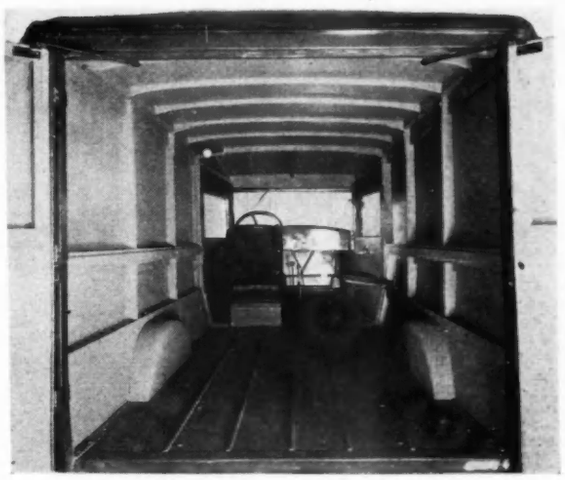
De luxe cabs do not differ structurally from standard cabs, but they are equipped with automatic windshield wipers, cowl ventilators and chrome-plated cowl bands and lights, and they are finished with leather trim. Trim and finish also account for the major differences between standard and de luxe screen and panel bodies. For instance, the de luxe models carry chrome-plated stanchions and headlamps, etc., while in standard models only the headlamp rims are chrome-plated.

Body dimensions give further evidence of the policy of simplification which has been adopted. Body lengths vary by increments of 1½ ft. from the 7½-ft. to the 12-ft. size, and in steps of 3 ft. from there up to the largest body, the 21-ft. size. The following table shows how the wheelbases of the various models have been worked out in combination with the body lengths.

Std. Body Length	Center Line of Rear Axle to Back of Cab—In.	Models	Tonnage Ranges
7½	48	T-15 to T-25	¾ to 1½
9	59	T-15 to T-44	¾ to 3
10½	70	T-19 to T-82	1½ to 4
12	82	T-30 to T-82	2 to 4
15	99	T-42 to T-90	2½ to 5
18	116	T-60 to T-90	3½ to 5
21	135	T-90	5-ton range

The tonnage ranges here given represent an average load with average tire equipment, and not the maximum gross weight rating of which each model is capable. Smaller bodies than those given can be used, of course, but considerably larger bodies cannot be used in each case without bringing the center of load back of the rear axle center line. As laid out by G. M. T., these body sizes place the center of load just about 6 in. ahead of the center line.

Of the body equipment offered by the factory, there

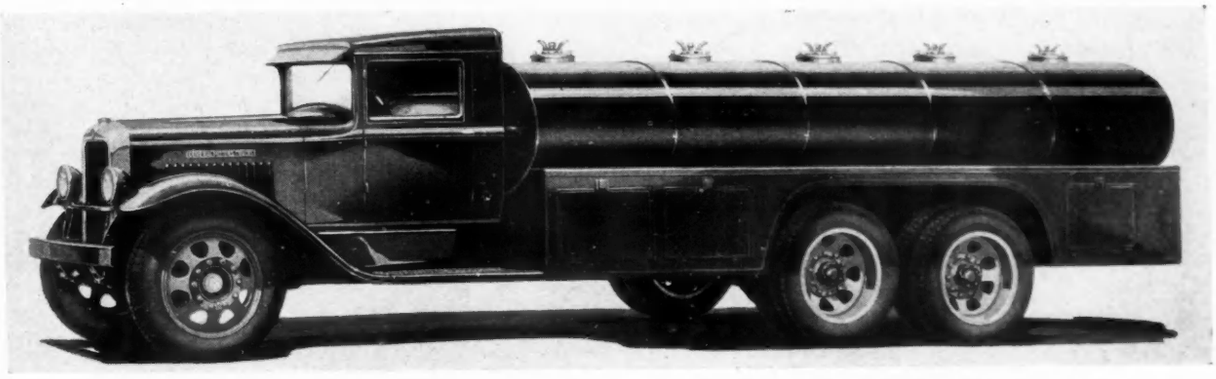


Interior of the 7½-ft. panel body adopted for use on all General Motors Truck models up to and including the T-30

are 7½ to 10½ ft. screen side and panel deliveries, with wheel houses designed to accommodate all trucks from the T-15 up to and including the T-30 models. Other bodies offered include a slip-on 7½-ft. express body for the T-19 1½-ton range, and 9 to 12-ft. bodies without wheel housings of the following types: Meat-packer's type open express, platform steel stake, platform body, and platform with stock racks. Canopy top expresses, grain sides, etc., are available at extra cost.

Only two hub sizes are used for all models from the T-30 up. The latter, the same as the T-42 and the T-44, takes hubs with six studs, while the T-60, T-82 and T-90 take hubs with eight studs. Web steel or Michigan malleable wheels are used on Models T-19 and T-25 to simplify change over in tire size, while Models T-15 and T-17 carry Jackson Steel Products Co. standard wood wheels.

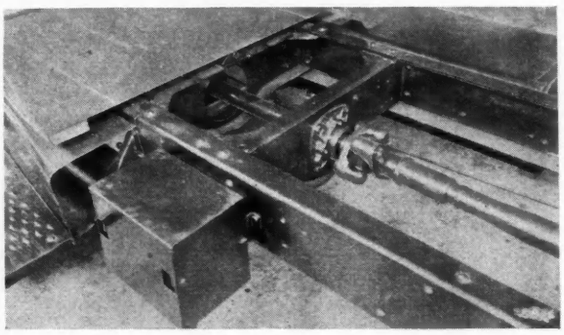
All trucks are powered by six-cylinder engines,



Tank truck built on the General Motors T-90 chassis with a straight rating of 28,000 lb. and a pay load capacity of 5-7½ tons

Models T-11 to T-19 taking the modified Pontiac powerplant; Models T-25 to T-44, the 257-cu. in. Buick engine, and Models T-60 and up being powered with the larger, 331-cu. in. Buick engine.

Perhaps of greatest interest from a design point of view is found in the frame channel stiffener used on all except the T-11 and the short wheelbase Models T-17 and T-15. This "stress absorber" (as it is called by the manufacturer) consists of an angle iron fitting into the frame side channel and riveted to its web and upper flange. The angle iron is of about the same length as the cab and extends equal distances forward of and back from the rear edge of the cab. On the Model T-90 a channel replaces the angle iron and extends back to the forward joint of the radius rod of the Timken six-wheel tandem-axle unit. This reinforcement centers around the point of maximum bending stress, which is located roughly where cab and body meet.



Detail of frame construction on General Motors T-82 model, showing the reinforcing angle in the frame side channel

Helper springs are now standard equipment on all models from the T-30 up. They are optional at extra cost on the T-19 and the T-25. Fuel tanks, which are carried just inside the running board, are now located at the left of the frame on the light-duty and at the right of the frame on the Buick-engined models, so that they are on the side opposite to the exhaust. They are supported from the frame side rails by outriggers and straps. On several models the size of the fuel tanks has been increased. Gas gages are located on the tanks. Batteries are located under the cab floor to the right of the driver's seat.

Brakes are of the Bendix two-shoe four-wheel type on all except the T-11 ½-ton range, which has Midland Steeldraulic brakes as last year; and the T-90, which has Westinghouse air brakes on both sets of rear wheels. Steering gears are now of the roller bearing worm-and-three-tooth-sector type.

Frame assemblies for the total of 33 chassis models number only six. There are only five transmission assemblies, five front springs, three front axles, three radiator cores, three tanks, etc.

Of special interest is the new T-90 six-wheeler. Its rear axles are of the Timken tandem axle S. W. unit type described in the April 27, 1929 issue of Automotive Industries. It is powered with the 331-cu. in. Buick engine, has Westinghouse air brakes, as already mentioned, and incorporates a new type of five-speed separately mounted transmission.

This transmission unit is manufactured for the General Motors Truck Co. by the Brown-Lipe Gear Co. It is supported from the clutch housing by a ball joint and from the frame side rails at the rear through two brackets. Ball bearings are used on all shafts. The gearshift lever is mounted on a forward extension of the gearcase, and some of the advantages of a unit powerplant are combined with those of a separate transmission. Gear reductions range from 10.2 for the low reverse and 8.82 for the first gear forward to 1.91 for the fourth speed forward, the fifth being the direct drive. The standard axle ratio is 9.25 to 1 and an option is given on a special ratio of 10.33 to 1.

General Motors Truck Line

Model	Wheelbases	Maximum Body Sizes	Straight rating	Nominal Payload (ton range)	Lowest Chassis Price	Engine Hp.	No. of speeds Transmission	Rear Axle type	Standard Axle Reduction
T-11	1	Special	3800	½	$625	58	3	spiral bevel	4.42
T-15	2	7½ & 9	5400	¾	695	58	3	spiral bevel	4.86
T-17	2	7½ & 9	6500	1	735	58	3	spiral bevel	4.83
T-19	3	7½, 9 & 10½	8500	1½	895	58	4	spiral bevel	6.20
T-25	3	7½, 9 & 10½	8500	1½	1235	76	4	spiral bevel	5.83
T-30	3	9, 10½ & 12	11000	2	1545	76	4	spiral bevel	5.63
T-42	4	9 to 15	14000	2½	1845	76	4	spiral bevel	6.57
T-44	4	9 to 15	15000	3	1955	76	4	double reduction	8.05
T-60	4	10½ to 18	18500	3½	2970	94	4	worm drive	8.50
T-82	4	10½ to 18	22000	4	3790	94	5	worm drive	10.33
T-90	3	15 to 21	28000	5	5885	94	5	tandem worm	9.25

The table shows roughly how the new models fit into the General Motors Truck line.

Just Among Ourselves

Economic Forces Serve to Stabilize Industry

AS 1930 runs on, early sales and production returns continue to indicate that the conservative estimates, which forecast a satisfactory, stabilizing year for the industry, are likely to be proved true.

Possibilities of too fast a speeding-up as the spring wears on still appear as incipient dangers in the minds of some commentators. This group professes to believe that, as regards overproduction and forcing of cars on dealers, some factories have had only a camp-meeting revival conversion altogether too startling to stand the test of time.

Without arguing the case on that basis at all, we see no reason to be disturbed by these fears which seem to beset this group of automotive analysts. Our disagreement rests upon purely economic considerations; the elements of ethics or sincerity of purpose don't enter. Approached from any one of several basic economic angles, forces seem to us to be at work which will prevent any serious overproduction of automobiles or overloading of dealers this year.

* * *

C.O.D. May Control Over-Accumulation

FINANCIAL conditions affecting the average automobile dealer, for example, would appear to be so shaping themselves as to make very difficult an over-accumulation of cars so long as factories continue to demand cash on delivery. Let's look for a moment at the sources of financial resources for the average dealer. They are four in number:

1. Original capital brought into the business by himself;
2. Bank loans;
3. Personal loans;
4. Finance company accommodations.

The original capital investment in weak automobile dealerships has already been so seriously impaired in many instances as to leave relatively little chance of drawing large sums from this source to pay for any great number of new cars in excess of current retail sales.

Local banks, on the average, have come to scrutinize automobile dealer accounts very carefully, and their average experience in the last six months won't tend to make them any more liberal. The average dealer probably won't be able to get a great deal of money from his local banker to buy an excess stock of new automobiles—or even a sufficient number to permit him to get himself into a bad used car way; the bankers now look at the used car inventory as well as the new. Personal loans are much in the same category.

* * *

Finance Companies Are More Careful

THE average dealer is dependent upon finance company accommodations to take care of floor-planning a majority of his cars and to take care of financing retail time sales on a vast majority of his cars. And here again the current situation would seem to be such as to emphasize permanent stability and conservatism rather than liberal extension of terms and credits to make possible forcing of the market.

Repossessions on the average have been high in recent weeks. Some dealers have been unable to meet their obligations as regards repurchase agreements with the finance companies. Some dealers have gone out of the picture as a result; so have some finance companies.

Finance companies as a whole have suffered from repossessions. The result is a general tightening of the whole situation, a closer scrutiny of all paper offered and a more general refusal on the part of all finance companies to take chances—even as a favor to good customers. And finance company executives will tell you that "Money is not cheap when we try to get it, no matter what it says in the newspapers."

* * *

Conservative Confidence Begins to Replace Fear

LOOKING over the whole financial aspect of the dealer picture, then, it would seem as though the financial sources upon which the dealer relies for accommodation are all in a frame of mind likely to help materially in protecting the dealer from himself and indirectly from any attempt at forcing on the part of factories.

Factory executives as a whole realize this condition; a vast majority of them, we believe, sense the utter hopelessness of attempting any forcing of cars under such circumstances if dealers are to continue to go forward.

In this clearer recognition, as well as understanding, then, of the dynamic economic forces at work within the industry, would seem to lie reasonable assurance of a continued balance between automobile sales and production this year.

And when we add to this the really sincere desire—which we honestly believe does exist—on the part of a majority of factory executives to better the conditions of the automobile dealer, there is every reason to continue to believe that 1930 will go down in history as having been a great constructive, stabilizing year in the automotive industry.

Fear is rapidly being replaced by conservative confidence. The belief that workers will win in 1930 is growing—and the automotive industry has more than its share of real workers. As an industry, it will win in 1930 as in almost every previous year since its inception.—N.G.S.

Fixed Method Preferred in Grinding Cemented

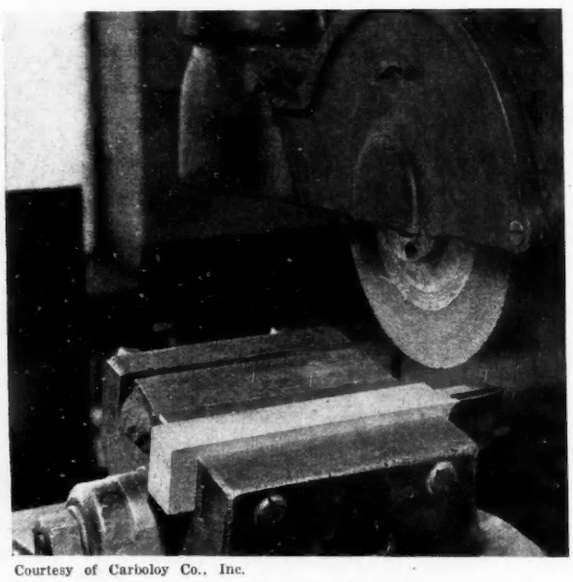
As material to be ground is very valuable, high-speed steel is shaped. Success on grade, special de

By H. W.
Research Laboratories,

BECAUSE cemented tungsten carbide cannot be machined with any known metal tool, it must be shaped finally by means of a grinding wheel, an abrasive hone, or by loose abrasive. The metal is made usually with rectangular cross section close to that of the finished tool bit or cutting tooth. Major operations, then, are the original grinding to shape, and later, resharpening.

The material is very valuable and only small amounts are to come off; therefore, wheel cost is of much less importance than when grinding steel. The best make-up of grinding wheel is desired. The roughing wheel must cut fairly fast without injuring the tool by heat and pressure. Localized heat tends to check or crack the carbide structure while excessive pressure and heat tend to chip the cutting edge. Finishing wheels must produce a smooth and true surface, especially fine at the cutting edge of the tool.

Tool bits or teeth are usually inserted in steel by brazing with copper or brass. However, some of the larger tools are made up by welding. Grinding the bit alone is one problem. When three metals must be ground in one cut, the problem becomes complicated, as one wheel is not best suited to all the metals. The coarsest of the better grain sizes for tungsten carbide is still fine enough to encourage loading by the softer metals.



Courtesy of Carboloy Co., Inc.

Tool set-up for grinding in vise. Greater accuracy is insured than by the off-hand or free-hand method

Grinding Resistance—The reader may at times lose sight of the very special problem involved in the grinding of cemented tungsten carbide. Therefore, space is taken right here to emphasize the situation. It is said that the metal is ground successfully by various operations and set-ups. That does not imply, by any means, that it is ground as readily as the most difficult tool steel.

A single surface to be rough ground is not so bad because the wheel may be kept sharp by wear, and the question of accuracy is not prominent. But when it becomes necessary to finish the several, or many, teeth of a reamer or cutter, or to grind a rectangular slot without taper or filler, the task is not so easy. If the wheel is soft enough to keep quite sharp by wear, it will lose its shape, leading to inaccurate work. If the wheel is hard enough to hold its shape for long, it soon becomes too dull to cut freely. Success is reached by a compromise on wheel grade, by special machine devices, and by tricks of feeding.

Some idea of rates of cutting and of wheel wear is given by figures for typical operations. Rough surfacing with the periphery of a ½-in. wide wheel, suited to the work: feed of 0.0005 in. per pass, with one-third or more of the feed consumed by wheel wear.

Freehand rough grinding of a tool bit on the periphery of a recommended wheel: 1.2 grams of metal removed per minute, 6.0 grams of wheel wear in the same time. Rates for similar grinding on hardened high speed steel are about 2.5 grams of metal removed, and 0.25 gram of wheel wear using a wheel suitable to the steel. By this comparison, ratio of material removed to wheel wear is 50 times as great for high speed steel as for cemented tungsten carbide.

Methods of Grinding—At first, grinding was almost entirely freehand or offhand. That is, the tool was held by hand against the wheel, with or without a work rest. This, of course, limited production to comparatively simple shapes of tools. Now, as experience has been gained, as more suitable wheels and improved methods have been applied, and as the demand for formed tools has grown, all ordinary forms of grinding operations are performed successfully. They include surfacing, internal and external cylindrical, and tool and cutter operations.

Light freehand pressure was a safeguard against injury to the metal. When wheel and work are forced together by rigid machine feed, as when the work is

to Free Hand Operations *Tungsten Carbide* Tools

wheel cost is of less importance than when ful methods include compromises vices and feeding skill.

WAGNER
The Norton Co.

held in a vise, something must give way or excessive pressure and heat will be built up. If the feed is too much, the wheel will wear too much and lose its shape, or the work will be injured by pressure and heat. Recently, the General Electric Co. has been and is now successfully using grinding machines with spring pressure between wheel and work for precision and semi-precision operations. Thus the safeguard of hand (spring) pressure is combined with machine accuracy. The spring may be located between the hand feed wheel and grinding wheel spindle bearings, or may exert an axial pressure against the wheel spindle when grinding is on the side of the wheel. The practice is to rough and finish grind with the same 60-grain wheel.

Spring pressure is not so necessary on external cylindrical grinding where the arc of contact is shorter than for surfacing or for grinding the lands of the teeth of a cutter. In all cases, a fast but practicable work speed, traverse or other work movement is recommended to prevent excessive localization of heat. This applies also to freehand work.

Precision grinding can be done without spring pressure, but with less speed. About the same wheel may be used for both kinds of grinding, but with rigid feed, selection of wheel is more critical, feeding must be more cautious, and more time and patience must be provided than for spring pressure grinding.

Success of spring pressure does not mean that a machine in poor condition will be successful. Bearings should be snug, ways true, and feed mechanism reliable, so that all machine motions are accurate. Belts must be tight to maintain wheel and other speeds.

Cutting off is an operation which is difficult to complete under ordinary conditions without having the piece break off ahead of the cut. So advantage is taken of this situation by nicking under heavy feed with a hard wheel at the desired point. Pressure and heat start a crack, after which the piece can be removed by tapping. The fractured surface is then ground smooth. Thin wheels have to be made with organic bonds, but vitrified structure can be used by ordering vitrified wheels 3/8 in. or 1/2 in. thick. The wheel is thinned down at the periphery to about 1/16 in. or 3/32 in. For actual "sawing," very high speeds of organic wheels are of advantage, but the pressure should be increased to take advantage of the high speed.

Wheel speed for general grinding usually is not critical, except for safety. Surface speeds generally range between 4000 and 6000 ft. per min. Most wheels used are of soft grade and, therefore, of low strength. For this reason, special attention should be exercised to see that speeds recommended by the wheel maker are not exceeded. Otherwise, there is danger of wheel breakage by centrifugal force. If it is necessary to sacrifice rate of cutting to low generation of heat, low wheel speed will accomplish the result.

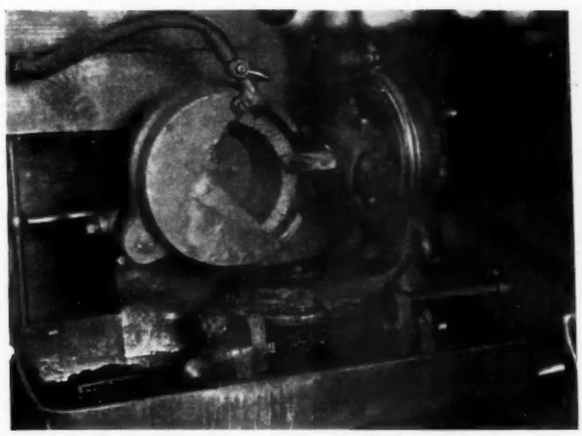
Remedies Suggested—When grinding of tungsten carbide is not so successful as was expected, there are three possible explanations:

1. Ease of grinding may have been overestimated.
2. A different grain or grade of wheel may be more suitable.
3. Grinding conditions may be modified to create better action.

The following suggestions are added to those already given:

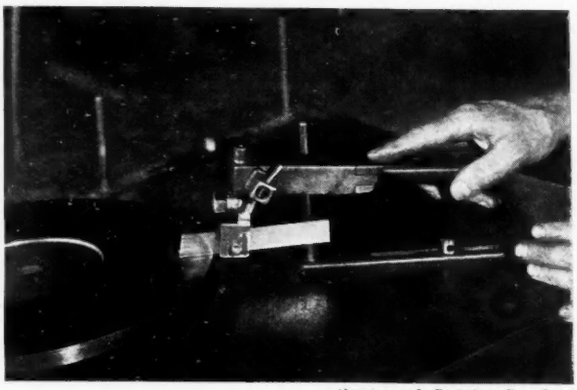
If the wheel appears to wear too fast, try lighter pressure or feed and take care not to gouge the wheel. Experienced operators know that little is gained in rate of cutting by using more than mild pressure between tungsten carbide and the grinding wheel.

If the wheel appears to act too hard, as evidenced by glazing, heating of the work and slow cutting, perhaps the pressure is too mild or the area of contact too great. A rougher dressing may help out. Revolving steel dressing cutters have less tendency to dull the wheel face than has the diamond or an abrasive brick.



Courtesy of Firth-Sterling Steel Co.

Machine grinding of tool angles using a Gisholt machine with cup wheel



Courtesy of Carboloy Co., Inc.

Periphery of wheel shaped to surface grind a form cutter

Set-Up of Work—While freehand grinding is recommended for rapid grinding with minimum danger of injury to the work, finish, accuracy of clearance angles and keenness of edge are enhanced by holding the work in a vise. Tool and cutter grinding machines come equipped with vises which can be set to hold the work at various required angles.

For "fixed" grinding, as when the work is held in the vise, the periphery of a straight wheel should be used whenever practicable. Its action is much more free than is that of the side of a cup or saucer wheel. Employment of shaped wheels is, of course, necessary for certain operations, as finishing certain lands on cutters, taps and so forth. Grinding on the side of the wheel has less tendency to gouge it, hence the cup or saucer is of advantage in holding its size when accuracy or work is a serious problem.

The concave or "chip-breaker" on the top surface of a tool, back of the cutting edge can readily be done freehand, as there is no need for great accuracy or a very smooth finish there.

When a cutting edge is ground, set-up should be so that the wheel's abrasive points travel from the edge to the body of the metal. This arrangement minimizes the tendency to chip the metal edge.

It is, of course, desirable to keep the wheel fairly true in order to secure maximum time of contact. However, on operations where accuracy of work is not affected seriously, a slight out-of-round or out-of-truth condition of the wheel may be a good sign. It is evidence of wear necessary to keep the wheel sharp. Chatter marks are quite common when rough grinding by approved practice.

Tool angles and clearances are specified by those who supply the metal, and have no special bearing on the grinding problem. Therefore, they are not discussed here.

Pressure and Feed—The proper pressure for freehand grinding is that which is a little short of gouging the periphery of a Crystolon 60-H wheel when a moderate area of cemented tungsten carbide is ground on the periphery of the wheel.

For "fixed" surface grinding, the direct feed should depend upon cross-feed. If the feed is straight in with no cross-feed, a direct feed of about 0.0005 in. per cycle of two passes is typical of good practice. If a cross-feed of 0.030 in. per pass is used on roughing, a direct feed is recommended of about 0.003 in. each time over the work.

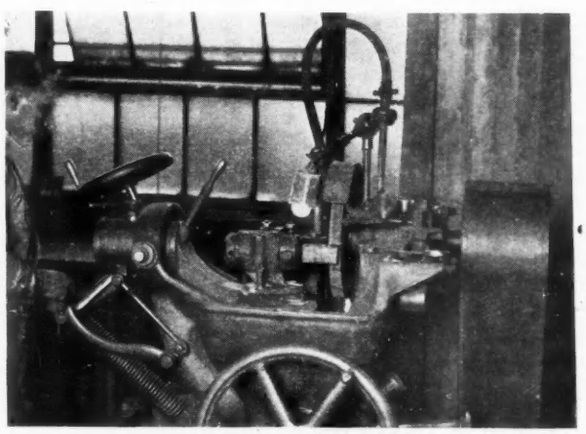
Wet Grinding—Tungsten carbide tools can and are being ground successfully both dry and wet. Recommendations on this point depend upon the source and upon circumstances. The situation is similar to that with high speed steel. When grinding is mild or when only a small amount of tungsten carbide is to be removed, dry grinding is recommended as being safer. On production work with a skillful, intelligent operator, wet grinding enables him to turn out work more rapidly but calls for a harder wheel.

There are two ways of applying the water or cooling solution. One is to keep the working surface of the wheel wet (not flooded) by a small stream or drip at a point away from the work. This method is of advantage when it is difficult to reach the grinding contact with a direct stream of water. The other method is to continuously flood the area of contact between wheel and work. In no case must the supply of liquid be intermittent. Alternate heating and cooling sets up destructive strains, because of the low resistance to mechanical distortion of the metal.

A hot tool bit never should be immersed in water. If necessary to cool a brazed tool more rapidly than by still air, dip the steel in water, but do not allow any part of the bit to come closer than ½ in. from the water.

Lapping and Honing—Lapping and honing are slow operations, performed to improve the finished appearance, to secure closer accuracy, and to refine the cutting edge. A rough grind tends to leave the edge or corner slightly chipped. A slightly chipped cutting edge has been found to be less durable than one more finely finished. Improved methods and selection of wheels have replaced, to some extent, lapping and honing, by grinding, which is, of course, much faster. In representative shops, about 5 per cent to 10 per cent of the tools made are lapped.

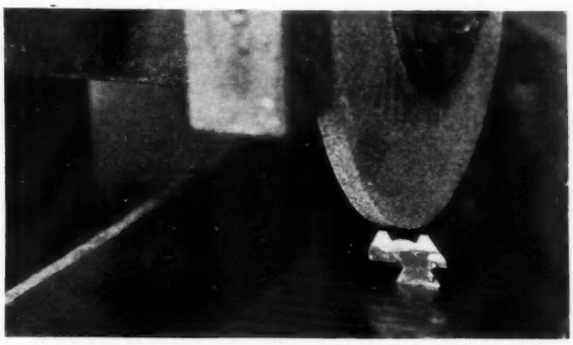
Lapping is done on the sides of revolving disks made of cast iron, aluminum, brass, copper or other material. Areas lapped are limited usually to flat surfaces. In one shop, an 11½-in. disk runs at 1800 r.p.m. In other places, speeds are lower. The work is held in various ways, as freehand with or without a guide rest, or clamped in an indexed fixture. Planetary motion of the work described by a machine attachment has been used also.



Courtesy of Firth-Sterling Steel Co.

Machine grinding of tool angles using a Sellers machine with a straight wheel

Silicon carbide, boron carbide and diamond powder are the abrasives used. The abrasive is mixed with a vehicle and spread on the disk. Vehicles include water, kerosene, lubricating oil, olive oil, almond oil, grease, and so forth. The thinner vehicles, as water and kerosene, are recommended for machines which circulate the mixture. Most lapping is done, however, without circulation, and the finest finish is secured by wearing down an application of the abrasive mixture after it has been spread on the disk to be used for lapping.



Courtesy of Carboloy Co., Inc.

Horizontal lapping disk with tool held in fixture

Silicon carbide and boron carbide are economical for rapid removal of material by lapping. Diamond dust or powder is faster cutting than either of the two carbides just mentioned, when it is used in generous quantities. However, its high cost tends to prohibit its use in such quantities. Boron carbide laps faster than silicon carbide but costs several times as much by the pound.

Silicon carbide and boron carbide are more inclined than diamond powder to leave a cloudy surface, but the edge is keen. Diamond dust leaves a polished but slightly lined surface and a keen edge. These comparisons are made from results using a cast-iron disk and olive oil as the vehicle for each abrasive. The diamond lapped surface is more pleasing to the eye, but it is pointed out that the degree of fineness to which a cutting edge of cemented tungsten carbide can be brought is limited by its structure. Although very fine, it is granular.

Honing is done by hand to touch up cutting edges after grinding. The hones, stones, or sticks are made of bonded silicon carbide. A considerable range of grain and grade can be used but they are finer and harder than the wheels used for grinding the same tools.

Another use for hones is to remove particles of metals being cut which stick to the cutting edge of the tool. A somewhat coarser stone is suitable for this purpose than for touching up after grinding.

Hones or stones may be used dry or with oil. A smoother and at least as fast an action is obtained when oil is used. Grain and grade are not critical, but should be chosen according to the finish desired. An edge honed by a 320-grain stone has about reached the limit of keenness imposed by the structure of the metal.

Selection of Wheels—The following suggestions are offered to aid in the improvement of wheel selection. They assume proper operating conditions.

Wheel does not hold shape: try a finer grain size, harder grade or both.

Wheel does not cut freely enough, or overheats the work: try a softer grade. In most cases 60/1 is the optimum grain size for fast cutting of tungsten carbide alone.

Wheel loads too much when grinding steel along with the tungsten carbide: try coarser grain size, or perhaps a softer grade.

Difficulties which are first blamed on the wheel sometimes may be overcome by a change in operation. See *Methods of Grinding.*

Occasion is taken here to emphasize the effect of area of contact. If the work consists of a series of points or small areas, they will have a dressing or gouging action on the wheel, and the grade should be harder than first choice as tabulated later.

Wheels recommended at this time are for the so-called "tougher" of the commonly used grades of tungsten carbide tools. For harder and more brittle varieties the tendency is to go finer and softer with wheel selection. New developments in grinding methods and other changes in properties of the metals may lead logically to further modification.

Abrasive and Grain Size—One type of abrasive is used universally in wheels for grinding cemented tungsten carbide. It is silicon carbide, made in electric furnaces. Industry was fortunate in having the manufacture of this abrasive carbide on an economical and commercial basis before the advent of the carbide metal tool. Silicon carbide is hard enough and strong enough to work the tungsten carbide.

S. A. E Aeronautic Meeting

(*Continued from page 362*)

He expressed the belief that 25 machines was a good initial run, as it would make possible a proper distribution of tooling cost without tying production up for too long a time, thus preventing the engineering department from introducing desired improvements.

"Factors Peculiar to the Manufacture of Aircraft Engine Parts" was the title of the second paper presented at this session. W. F. Wise, sales manager, Ex-Cell-O Aircraft & Tool Corp., the author of this paper, pointed out that the aircraft industry in its development totally eclipsed other branches of the automotive industry in the requirements it has set for material strengths, heat-treating, and production of new alloys.

Radio Equipment Discussed

INTERFERENCE of electrical disturbances emanating from the ignition system, with airplane radio communication, was given the lion's share of attention at the radio session. It was referred to as a problem of primary importance by each one of the three speakers, and the pros and cons of shielding got a rather thorough airing in the discussion that followed each paper.

Of the three speakers, E. A. Robertson of the Radio Frequency Laboratories, who presented a paper on "The Suppression of Ignition Interference on Radio-Equipped Aircraft," prepared jointly by himself and Dr. L. N. Hull, also of the Laboratories, emphasized that their experience had shown the absolute necessity of complete shielding of every part of the ignition system.

In the discussion of Mr. Robertson's paper, Herbert Hoover, Jr., son of the President and radio engineer for Western Air Express, stated that no shielding apparatus had yet been developed which was thoroughly satisfactory to transport operators.

Initial Cleaning and Preparation Are of Major *Importance*

Rust-proofing processes and the several stages of coating are discussed by Frank P. Spruance and George F. Farnsworth at the meeting of the Pennsylvania Section of the S. A. E.

AT the February meeting of the S.A.E., Pennsylvania Section, two papers on subjects connected with the finishing of automobile bodies were read and discussed. The first of these was by Frank P. Spruance, sales manager of the American Chemical Paint Co., Ambler, Pa., and dealt with "The Proper Preparation of Sheet Metal for Finishing," while the second was by George F. Farnsworth, director of the Detroit laboratories of the Edward G. Budd Manufacturing Co., whose subject was "Automobile Finishing Processes." Walter A. Graf, director of foreign engineering, Edw. G. Budd Manufacturing Co., presided at the meeting. Mr. Spruance's paper, which was of considerable length, is abstracted in the following, while Mr. Farnsworth's paper is given in full:

"The most serious offender undoubtedly is rust, together with those chemicals that produce it and accompany it," Mr. Spruance stated. "Second, may be placed oil, graphite, grease, lacquer, friction paste, dried paint, etc. Third, alkalis. Fourth, those miscellaneous foreign materials which, for want of a better name, may be called dirt and which must be removed if a smooth unbroken finish that will exclude atmospheric rusters is to be obtained.

"Rust as such, and if possible, without the prolific breeders that produce it, is not harmful. Materials similar to it are used as pigments in our best primers. The danger of rust lies rather in the presence of the rust-forming chemicals that produce and accompany it and which will, unless removed or destroyed, set up a continuous rusting cycle under coats of oil or paint. The removal of rust is therefore looked upon as necessary today, not only to remove roughness in an otherwise smooth surface, but, principally, so that the invisible chemicals beneath the surface coating can be dealt with so that they cannot continue their destructive cycle.

However, the day is probably not far off when the plant chemists and the painters will differentiate between 'active rust,' rust accompanied by rust-producing chemicals, and 'inert rust,' in which the rust breeders have been completely destroyed; and without doubt they will consider it safe to prime over 'inert rust' if not too rough, which has no other effect than to slightly increase the pigment in the primer.

"Rust-forming chemicals, which under favorable conditions produce rust, are encountered at various stages in the fabrication of the sheet metal products, starting as far back as the pickling of the sheets or strip in the steel mill. Here the hot-rolled sheets are pickled to remove the mill scale in a bath of sulphuric acid (an active ruster). After what usually amounts to an almost futile attempt to neutralize the pickling acid, they are washed in muriatic acid to remove a light rust coating due to this incomplete neutralization. Muriatic acid is a worse ruster, if possible, than the sulphuric acid used to remove the scale. To be sure, the sheets are removed from the muriatic acid and washed in water; they are scrubbed with brushes and dried over a gas flame or a coke fire before they are cold-rolled, but this treatment cannot suffice to remove or neutralize either of the rust-forming acids, which are left on the sheet as it comes from the mill and which will develop rust when the conditions become favorable.

Impurities Are Stimulators

"In addition to these active rusters, sulphuric and muriatic acid, that are embedded in the sheet's surface in the mill, there are alloying materials or impurities in the steel itself, which stimulate rust.

"That rust does not develop immediately on the sheets is due to the fact that they are kept dry in the mill warehouse until the oil coating is applied, and then they are loaded in box cars and carefully wrapped to keep them dry. When the sheets reach the stamping factory they should be (and usually are) stored in dry, heated warehouses, all for the purpose of eliminating those conditions that will allow these unseen rust stimulators to develop, and while rust on sheets in the warehouse is not prevalent, it must be remembered that these clean-looking sheets have rust producers on them that must be counteracted before they are covered with the finish coats.

"Perhaps the next attack of rusters is encountered in the handling of the sheets or formed panels in the press shop, where some of the mill oil is removed and

Effect of Cleaners

METAL cleaners should have the following effects, Frank P. Spruance told the Pennsylvania Section, S. A. E., last week:

First—Remove oil, grease and anti-squeak, etc., so that the entire metal surface can be acted upon.

Second—Remove rust and destroy all rusters.

Third—Remove alkalis and destroy their paint shedding action.

Fourth—Produce a surface to which the prime coat will adhere tightly.

# of Sheet Metal *Surfaces of Bodies* in *Production*

where perspiration from the workman's hands and probably acid fumes from a pickling tank located nearby, are deposited on the metal. The most serious ruster, however, is encountered the first time any soldering is done, whether in the press shop, in the sub-assembly departments, or on the metal line.

"Soldering acids, salts, or pastes, are essentially zinc chloride, a deliquescent salt, and all of them that are suitable for soldering steel are active rusters. They form iron chloride, which when acted upon by the air is changed into hydrated oxide or rust. Zinc chloride fluxes are only effective on steel free from scale or rust. If these be present, they must first be removed before the surface can be properly tinned.

"The scale and rust coatings could, of course, be removed with a file or an abrasive wheel, if the surface were smooth, but, as in the case of welded seams, the surface is usually so irregular that embedded scale could not be removed without grinding entirely through parts of the sheet. It is therefore necessary to remove any scale or rust either prior to the application of the zinc chloride flux or to combine a cleaning acid with it.

"Formerly it was the practice to preclean with muriatic acid, known in shop parlance as 'raw acid.' This liquid volatilizes at room temperatures but much more rapidly with the heat of a soldering iron or torch, and both the liquid and the gas that comes from it produce rust; the liquid where it contacts with the metal being cleaned, but the vapors will be blown some distance and cause rust on any steel, particularly if free from oil, with which it comes in contact. All that happens when steel is acted upon by muriatic acid need not be discussed, but it is important to remember that the acid rapidly penetrates the surface and sets up a continuous rusting cycle.

Acid Cleaner Insufficient

"If rust from this cause is to be prevented it is necessary to remove or destroy all of the muriatic acid and its salts. It is obvious that it can neither be removed nor destroyed by any treatment which is confined to the surface or which might serve to dilute the acid. It should also be remembered that to neutralize the acid with an alkali will not suffice, for the resulting salts are themselves rust-producers and must be removed.

"The second class of materials to be removed is oils, graphite, drawing compounds, greases, etc. Oil is applied to the sheets at the mill; more oil and various greases are applied to the blanks on the press to facilitate the drawing. This class is not so harmful from the rust-producing standpoint, as from the effect they have on the finishing coats and the tendency to include within themselves or to cover rusters and hinder the removal of them.

"Thick coatings of oil tend to prevent good paint adhesion even with long oil primers, but with the quick-drying undercoats that are looked upon with increasing favor, complete removal of oil is of utmost importance. Dried paints and hardening oils, too frequently used in paddling solder, often seal over rusters that are consequently allowed to remain after the cleaning.

"Petroleum fractions and various solvents have long been looked upon as a satisfactory means for removing slushing oils and lubricants, but the ineffectiveness of these will be conclusively proved by running water on steel supposedly freed of oil by this method, and observing the break in the water film which even a trace of oil will produce. Alkaline baths and solutions are no more effective than the solvent detergents. In addition to not removing the oil films completely, these have the disadvantage of being less volatile and of leaving a coating of alkali on the surface that constitutes the third group of objectionable materials which should be removed.

"The presence of even a trace of alkali is highly objectionable on surfaces that are to be enameled; even the negligible amounts present in city water will cause alkali spots to develop, particularly in the humid months or in damp localities. Though the quantities of alkali are too small to readily detect, their presence will soon become evident through the enamel film.

"In the fourth group are the miscellaneous materials such as specks of solder, iron filings, grit from abrasive papers, sawdust, paint splatters and anti-squeak, which find their way on the panels in passing along the construction line. These must all be removed if a smooth, continuous coating of primer is to effectively seal the cleaned surface."

In taking up the subject of cleaners, Mr. Spruance said these should produce the following effects:

1. Remove oil, grease and anti-squeak, etc., so that the entire metal surface can be acted upon.
2. Remove rust and destroy all rusters.

Rust Not Harmful

"RUST, as such, and . . . without the prolific breeders that produce it, is not harmful," according to Frank P. Spruance, of the American Chemical Paint Co., who delivered the accompanying paper before the Pennsylvania Section, S. A. E.

"Materials similar to rust are used as pigments in our best primers. The danger of rust lies rather in the presence of rust-forming chemicals that produce and accompany it, and, unless removed or destroyed, set up a continuous rusting cycle under coats of oil or paint.

"The day is probably not far off when plant chemists and painters will differentiate between 'active rust' . . . and 'inert rust' . . . which has no other effect than to slightly increase the pigment in the primer."

3. Remove alkalis and destroy their paint shedding action.
4. Produce a surface to which the prime coat will adhere tightly.

In the second part of his paper Mr. Spruance described the various cleaning processes known under the name of deoxidine which are being exploited by the American Chemical Paint Co. These, he said, are based on a discovery made by George D. Feidt in 1914 of the cleaning powers of a mixture of phosphoric acid and alcohol. The original deoxidine method of cleaning, which is a wet method, has been in use for a good many years. More recently a new dry method of deoxidine cleaning was developed. The application of this method was described in an article in *Automotive Industries* of Dec. 7 last. The technique of cleaning by the wet process was described by the author as follows:

"First—The bodies must be prepared for the cleaning in which operations the dust, shavings and chips, left in or on the body from the construction line, are removed with a compressed air jet.

"Second—Paint splatters from slushing the inside of the body, anti-squeak used in the joints, lacquer used under moldings, and hardening oils, if they are used in torch soldering, must be removed in a precleaning operation by petroleum fractions and suitable solvents, because dried paint is one of the few things that this 'universal solvent' will not remove.

"Third—The bodies then pass onto the deoxidine deck, the floor of which is constructed of an acid-proof mastic. Here the deoxidine is applied, for a production of 30 or more bodies per hour, by two dopers, one on each side of the cleaning line, with large brushes constructed specially for the purpose. That liquid which drips off the body is caught in a V-shaped trough placed under the body sills and extending at least the full length of the body, which serve not only to catch the drips, but also as a reservoir for the liquid into which the brushes are dipped.

Reclaiming Deoxidine

"A substantial reduction in consumption is being made today in many of the body plants by collecting and reclaiming the deoxidine which drips off the body after it has passed beyond the drip troughs. To do this, the deck floor is so sloped that the liquid is led to a drain and from this it flows through Duriron pipes and fittings to a reclamation tank or barrel on the floor below the deck. The sediment settles to the bottom of the reclamation tank or barrel, and oil floats to the top. The reclaimed deoxidine is pumped from between these layers to a storage tank near the drip troughs where it is made ready for use again by the addition usually of an equal volume of the unused chemical.

"Fourth—As the bodies are carried along the line and while the deoxidine coating is still wet, two men scrub the entire surface with a large bundle of steel wool, to break up the oil film so that a complete acid action will take place on the metal and incidentally, any soldered areas or acid runs are scrubbed so that these nests of rust breeders can be completely destroyed.

"Fifth—The bodies then pass to a wash deck, where water is flowed over the panels with a hose. The washing can be accomplished most satisfactorily if the surface is wiped with a sponge while it is being flushed with the cold water. This wash with cold water is usually followed by a hot water rinse to facilitate the drying.

"Sixth—Wiping cloths dipped in hot water and wrung dry in a clothes-wringer are then used to remove all the moisture from the bodies, while they are still warm from the hot water rinse. Air is used to blow the moisture from open joints and from behind applied moldings, so the surface of the bodies is dry.

"Seventh—Oven-drying is the next operation. The customary ovens are used, and the temperature to which the bodies are heated depends, naturally, upon the time or oven length that is available. Ordinarily, the ovens are heated to a temperature of from 150 to 200 deg. Fahr. and from 10 to 20 min. suffice to dry the surface.

"Eighth—After the bodies leave the oven they are usually wiped all over with a rag dipped in alcohol, or, better, in a mixture of alcohol and water. This is in the nature of a pickup and an inspection operation in which the surface is examined to be sure that all rust has been removed, that all soldered areas and acid runs have been acted upon by the cleaning fluid, and that the washing operations have been performed satisfactorily. Any sticky runs or areas due to incomplete washing are removed with a fine abrasive paper."

Body Finishes Grouped

THE finish on the automobile body today can be divided into three major groups, namely, primer coats, filler or surfacer coats, and colored finishing coats, according to George F. Farnsworth, director, Detroit Laboratories, Edward G. Budd Mfg. Co.

"The original conception of pyroxylin lacquer body finish was an 'all-lacquer' finish, that is to say, pyroxylin primer, pyroxylin surfacer and pyroxylin lacquer colored enamels," Mr. Farnsworth said. "Today, however, we have other finishing systems, which in the main owe their conception to the difficulties encountered with the 'all-lacquer finish.' Such systems are:

"1. Baked oil-base primer.
Pyroxylin surfacer.
Pyroxylin color enamel.
"2. Baked oil-base primer.
Oil-base surfacer coats (separately baked).
Pyroxylin color enamel.
"3. Baked oil-base primer.
So-called 'One bake' or 'Synthetic surfacer.'
Pyroxylin color enamel.
"4. One Bake System:
Synthetic primer.
Synthetic surfacer.
Pyroxylin enamel.

"The one advantage of the pyroxylin lacquer undercoat system is that no large drying ovens are necessary. Its disadvantages lie in its high material cost; in the fact that all lacquer primers have a violent antipathy for oil and grease, necessitating very thorough cleaning, such as is not generally found in today's large production shops, and thirdly, in the fact that they dry entirely by evaporation only, hence shrink very appreciably. Unless dried thoroughly before sanding down, any underlying defects will show up with age. These materials, however, have economic advantages for use in custom repair or repaint work.

"The system using a baked oil-base primer and separately baked oil-base surfacer coats is probably the most durable known. Its disadvantage, however, lies in the large oven outlay necessary and the time consumed in baking the coats. As these materials dry by oxidation and not be evaporation, shrinkage, if any, is negligible.

"The system that is rapidly going into use in finishing bodies today is that one using for undercoats a baked oil-base primer and two or more coats of a synthetic resin surfacer. The most satisfactory prime coat—the important function of which is to furnish a

perfect elastic, durable bond between the cleaned metal and the following finish coats—is a baked oil-base primer. This type of primer is the only one of the many developed which will give consistently good adhesion and elasticity over metal as it is cleaned in production shops today, and it has been developed to a high degree to meet modern methods. In almost every case the satisfactory oil-base baking primer is a combination of a very high-grade wood-oil-base varnish and inert pigments among which iron oxide predominates. Naphtha is used to reduce it to the consistency necessary for application. It is a general rule that primers which are satisfactory for use under 'synthetic' or lacquer surfacers are 'long' enough to require a baking temperature of 200 deg. Fahr. for a period of 1 to 2 hr. These primers have been developed particularly as to the methods of application to meet the special requirements of the user. They can be obtained for application by spraying, by flowing, or by dipping.

"Glazing putties are available in all types of the above materials. Pyroxylin putties are used almost entirely for spot putty operations after the sanding of the surfacer coats. They dry fast and give satisfactory filling over small spots. Oil-base and synthetic resin putties are used to knife-glaze over large surfaces. The latter do not work as readily as oil-base putties. Owing to the rapid setting up by evaporation, they must also be worked thinner and therefore do not fill as well.

Pyroxylin Practically Unchanged

"Pyroxylin lacquer finishing enamels have not materially changed in their make-up in the last two years. They consist chiefly of nitrocellulose, gum, plasticizers, pigments and solvents.

"Steps have been taken to improve the covering qualities of light colors by the use of titanium oxide as a portion of the white pigment content. Settling troubles are encountered when these are mixed with zinc oxide in proportions of over 50 per cent.

" 'Orange peel' or pitting has been reduced somewhat by the use of high-boiling solvents in both the lacquers and thinners. This has necessitated low-temperature drying ovens. Sanding and polishing are still necessary to produce the lustre and finish required for passenger car bodies. Spray equipment has not been developed to a degree where it will eliminate this defect. There are, however, so-called 'lustre lacquers' available which give a finish as sprayed that is suitable for bus and truck bodies. These lacquers are made with a high blown castor oil content and harden slowly.

"Mechanical sanding and polishing machines have been developed to such an extent that they are in universal use in body shops today. The disk-type is the one in general use. For lacquer sanding and polishing, the disk is composed of felt or multiple layers of fine muslin. The abrasive medium is a water-base compound using cutting materials similar to the old hand polishes. It is, however, free from waxes, as these substances ball up on the pad and cause scratching. Some hand work is necessary to take care of details and to remove small circular scratches. Final clean up is done by using a lamb's wool pad over a felt polishing head.

"Mechanical striping guns have replaced many hand operations in production work. Hand stripers are still necessary, however, for touch-up work. The machine-made stripe is more even, heavier, and will stand up against abrasion longer than the hand-applied stripe. These machines, however, although used in production, are as yet in the development stage. One of the most successful ones is to be marketed soon by one of the paint-spray-equipment companies.

"Spray guns that will cut in beads and moldings without the use of tape and paper or metal shields are now being tried out in several plants. The results look encouraging. They will possibly be in production before the end of the summer.

"The production body plant is interested in two things, viz., first, a material or method which will produce an equal or a better job for equal or less money; and, second, a material or method which will save time in production—which means money.

"In the case of surfacers, both a better job is obtained and time and money are saved if synthetic materials are used, provided they are properly applied.

"Color enamels made by grinding colors in these same synthetic resin base materials are now being experimented with, and are being used in production on wood automobile wheels. With these resins it is possible to obtain a finish with a solids content as high as 75 to 85 per cent, which would indicate the possibility of some day obtaining the ideal color, i. e., a material which will cover solid and fill, flow out smooth and require no polishing.

"The main disadvantages of both the pyroxylin and baked oil-base surfacers has been offset by the development of the so-called 'one-bake' or synthetic surfacer. The pigments used in its make-up are the same as those used in the other surfacers. The varnish base used is manufactured from synthetic resins and China wood oil. It dries partly by evaporation, partly by oxidation and partly by condensation. Two to three heavy coats can be applied in rapid succession and baked in one oven operation, at the same temperature and for the same time as for one coat of the old type oil-base surfacer. In its working properties it is equal in every respect to the best of the oil-type surfacers heretofore used. It adheres strongly to the primer, has good filling and good sanding properties, and lacquer enamels adhere well to it. However, it is resistant enough to withstand the attack of lacquer solvents. It is not as elastic as the other type surfacers, and oven baking very materially affects ease of sanding. Synthetic resin primers of the one bake system type are not commonly used. Adhesion is poor in the presence of even slight oil or grease."

MAYBACH V-12 CAR

(Continued from page 365)

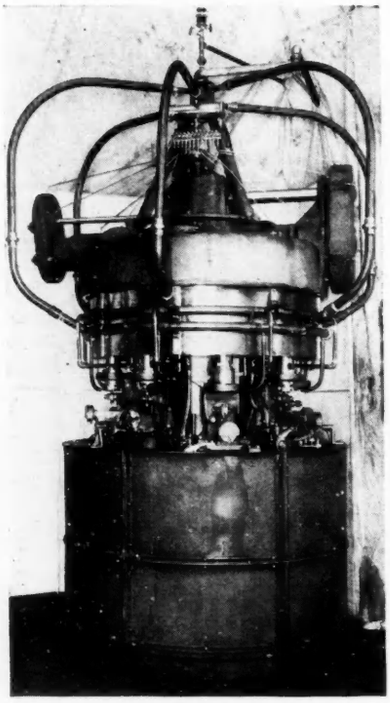
ing a rotary valve communicating with one of the inlet manifolds, and with a cylinder with a piston therein. A vacuum tank also is included in the system and serves to return the piston when required. A diagram of the control system is shown herewith. By setting a finger lever on the steering wheel vacuum can be admitted to either end of the working cylinder. The piston rod extending to the rear from the cylinder connects directly to the operating lever of the overspeed gear. The finger lever on the steering wheel can be set at any time when it appears likely that a change may become desirable. No shift will be made until the accelerator pedal is released and the engine throttled, the power of the vacuum device being so limited that it can effect a shift only under these conditions. It is not necessary to disengage the clutch to make the shift, the clutches employed being of such design as to operate noiselessly. The overall reduction between engine and rear axle is 3.58 to 1 with the overspeed gear in action and 5.66 to 1 otherwise.

Disk wheels are fitted and are equipped with 32 by 6.75 in. tires. The wheelbase is 144 in., the track 58 in.

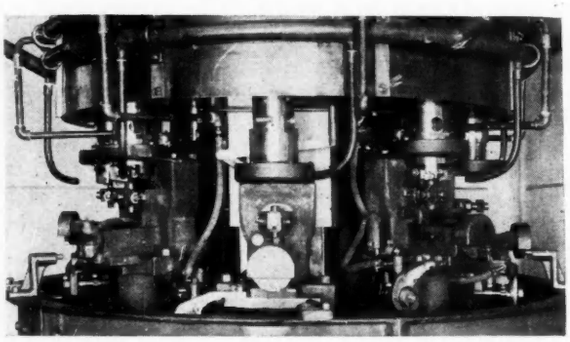
NEW DEVELOPMENTS—Automotive

Enterprise Multiple Indexing Machine

EXTENSION of the scope of the Enterprise multiple drilling machine is evidenced by the new heavy-duty indexing machine just completed by the Enterprise Mfg. Co., Philadelphia, Pa. The machine illustrated was built specifically to center, rough turn and face, the four spindles of a universal joint spider. Like the smaller model, this machine has eight vertically reciprocating fixtures. However, on this machine the fixture also incorporates a mechanism for indexing each spindle in proper sequence. Each fixture is provided with a quick-acting air-operated clamp operated automatically. Consequently the cycle is full automatic, the operator's duty being confined to loading and unloading the work at one station. A double-spindle is employed, the hollow outer sleeve carrying three cutters and rotating at 350 r.p.m. while the inner centering spindle is driven by an auxiliary set of gears at 1500 r.p.m. The cutter feed is 0.018 in. distributed over the three cutters. An estimated production of 10 pieces per minute is expected at a rotative speed of 1.25 r.p.m. of the fixture unit. Another feature is the centralized location of the lubricating system, and coolant and air supply, all mounted accessibly at the top of the machine. Lubricant is fed from a small reservoir by gravity to all bearings through the small individual oil leads, Coolant and the air supply for the fixture clamping device are taken from an outside source and connected to a distributing valve which leads to each fixture through the large tubes branching from the top. Chips are permitted to drop to the pan of the machine where a sweeper brush expels them through an opening provided for that purpose.



Enterprise heavy-duty multiple indexing machine

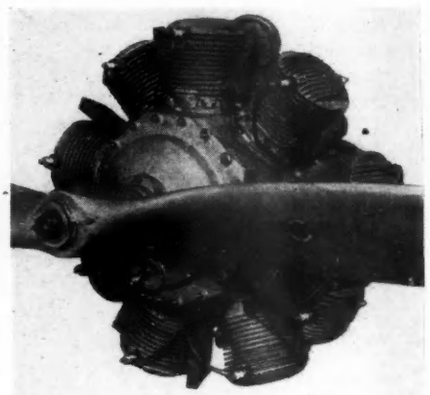


Indexing fixtures of Enterprise machine in detail

The machine illustrated here is equipped with a 15 hp. electric motor operating at 1750 r.p.m. However, the maximum capacity of the machine is said to be 8-1½ in. drills feeding 5 in. deep. Accordingly, the range in motor size is between 15 and 40 hp. Floor space necessary is a circular space about 6 ft. in diameter. Net weight approximately 26,000 lb.

Two-Cycle Radial Engine

A TWO-CYCLE air-cooled radial aircraft engine has been developed for production by the Aeronautical Engineering Co. of Oakland, Cal. It is the result of considerable experimental work by Earl Hilburn, Brint Edwards and Cliff Dorwin, executives of the company.



Two-cycle radial air-cooled engine

One of the most distinctive features of the engine is its low weight. It is said to develop 300 hp. at 1800 r.p.m. and to weigh dry, without hub or starter, 270 lb. The engine has nine cylinders with a bore and stroke of 4¼ in. each. Another advantage claimed for the engine by its designers is absence of vibration, which is due to the great overlapping of power impulses. There being nine cylinders, working on the two-stroke cycle, there are nine impulses per revolution.

Everything has been done to reduce the frontal area and thus cut down air resistance. The overall diameter is 31 1/16 in. As a means to reducing the overall diameter, a new design of crankshaft and a new type of connecting rod were developed. The cylinders are cast of aluminum alloy and are shrunk over steel sleeves, which latter are locked between the cylinders and the crankcase. The crankshaft is a two-piece single-throw type, made of nickel steel and provided with bronze counterweights. No master rod is used, which is another means toward lessening the frontal area.

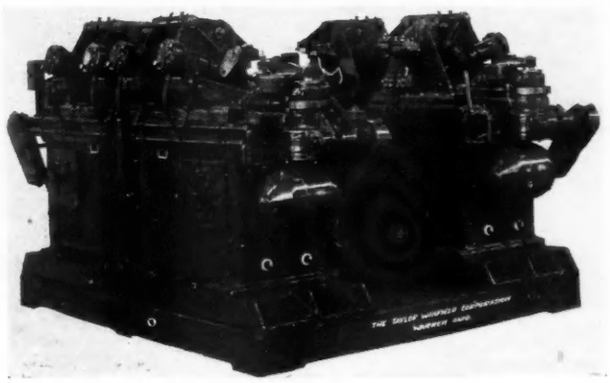
Combustible mixture is forced into the crankcase by a supercharger of a new type designed by Dorwin. It is of the direct-drive positive-displacement type, and assures sea level conditions up to an altitude of 5000 ft. This supercharger takes the place of crankcase pump, usually employed with two-cycle engines. Tests

Parts, Accessories and Production Tools

are said to have shown that it requires less than 4 hp. to operate the supercharger. At 1650 r.p.m. the fuel consumption is 0.52 lb. per b.hp.-hr. and oil consumption, 0.022 per b.hp.-hr. It is planned to start quantity production of the engine in the Oakland factory shortly.

Universal Corner Welder

FOUR individual welders mounted on a common base form a unit just placed on the market by the Taylor-Winfield Corp., Warren, Ohio. This machine makes available the high speed welding of four-corner jobs such as doors and windshields. Although each machine is separate and independent of the other machines, they are all synchronized electrically to start, flash, upset and retract in unison. The clamping is by means of air operated clamping jaws which apply pressure through a toggle action giving great clamping pressure for the small amount of air consumed. The jaws work in pairs and are controlled by air valve switches at the side of the machine so that the operator's hand must be entirely from underneath the jaws when clamping is energized. The electrical switches are dual and must be interlocked from either end of the machine



Taylor-Winfield four-corner universal welder

before the machine will operate. This necessitates the operator being back out of the way while the machine is in action.

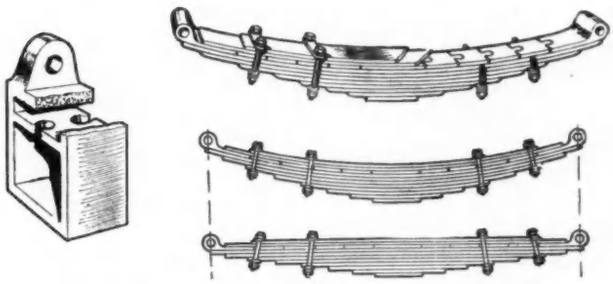
Estimated production 100 to 150 automobile door frames per hour.

Articulated Spring Leaf

A BRITISH firm of spring makers, W. Griffith & Sons, Sheffield, England, has introduced a new system of laminated spring construction in which the main leaf consists of numerous separate sections dovetailed into one another and thus articulated. This leaf does not assist in supporting the load, its function being merely to locate the axle relative to the frame.

A special feature is that a certain amount of "play" is provided between the various sections, with the result that the leaf is capable of accommodating itself to the differences in the effective length of the spring as a whole when its curvature varies with deflection. For that reason the need for shackles of any kind is eliminated.

The main leaf has two rebound leaves superimposed, these serving also to keep the dovetailed sections in place. Leaf clips of a special type are provided to insure longitudinal alignment, each of these consisting of a pair of bolts and nuts with washers having a hemi-



Chassis spring with jointed main leaf. Lower views show how spring length is unaffected by deflection. The drawing on the left shows a spring-locating box comprising the central section of the jointed master leaf

spherical face mating with the countersunk holes in two plates, so permitting relative longitudinal movement between the leaves.

St. Louis Aircraft Show

(Continued from page 359)

Prices of planes throw an interesting sidelight on what is being offered this year. Following are average prices, based on horsepower, amphibions being omitted for the sake of comparison:

Hp. Class	Average Price	Hp. Class	Average Price
60-90	$3,500	300	$13,500
100	4,000	400	17,500
150	7,000	500	26,500
200	8,000		

The reason for the sudden jump from $4,000 to $7,000 between the 100 and 150 hp. classes might be assumed to be largely due to the larger number of closed-cabin ships. But even eliminating these, the average price remains at around $6,500. The underlying reason probably is to be found in the low prices at which engines of the 100 hp. class are now available. All these price averages, however, at least up to the 300 hp. range, show a marked decrease over preceding years.

Among the new engines, there seemed to be about an equal division between the radial and in-line types. All of these were air-cooled. Kinner, in addition to a rather phenomenal price reduction on its 100 hp. five-cylinder engine, introduced a larger five-cylinder radial developing 190 hp. Fairchild showed its inverted four-cylinder in-line type, which has a rating of 120 hp. at 2100 r.p.m.

There were 21 different types of engines, of 15 different makes shown in the airplanes themselves. Ninety-four per cent of the planes had air-cooled engines, 86 per cent had radial engines, and 94 per cent of those shown were of the single engine type.

Of the new engines exhibited at the show, which, of course, were not yet to be found in the airplanes, the Warner Scarab Jr., and the 190 hp. Kinner are developments from existing types. In the case of the Warner, as many parts as possible have been made interchangeable with the larger seven-cylinder Scarab.

Automotive Oddities *by Pete Keenan*

First with the News

Reliable, Accurate

News of the Industry

PAGE 381 VOLUME 62 *Philadelphia, Saturday, March 1, 1930* NUMBER 9

Bendix Group Adds an Air-Brake Unit

Joins With a Westinghouse Division in New Operating Company

NEW YORK, Feb. 27—Announcement was made yesterday of the formation of the Bendix-Westinghouse Automotive Air Brake Co., all stock of which will be held by the Bendix Aviation Corp. and the Westinghouse Air Brake Co. The new corporation will take over operation of the automotive division of the Westinghouse Air Brake Company. The General Motors Corp.'s interest in Bendix is regarded as providing a large outlet for the products of the new corporation.

Operations will be confined to the Westinghouse air brake equipment for buses, trucks and other automotive lines. The Westinghouse company will do the manufacturing for the new company.

Officers of the new corporation are: Vincent Bendix, president of the Bendix Aviation Corp., president; S. G. Down, vice-president of the Westinghouse Air Brake Co., vice-president, and W. J. Buettner, treasurer of the Bendix Aviation Corp., secretary and treasurer. In addition to Mr. Bendix and Mr. Down, the directorate of the new corporation includes A. L. Humphrey, president of the Westinghouse Air Brake Co.; John P. Mahoney, vice-president of the Bendix Aviation Corp., and Victor W. Kliesrath, vice-president of the Bragg-Kliesrath division of the Bendix Aviation Corp.

Oakland Promotes Blees

DETROIT, Feb. 26—W. A. Blees, assistant general sales manager in charge of dealer accounting and management of the Oakland Motor Car Co., has been appointed sales manager, according to an announcement by W. R. Tracy, vice-president in charge of sales. Mr. Blees was appointed assistant general sales manager on Jan. 6, 1930.

Before joining the Oakland organization he was president of the Motor Accounting Co., a subsidiary of General Motors. Prior to that time he was associated with the sales and financial departments of Chevrolet Motor Co. for five years.

French to Require Two Brake Systems

WASHINGTON, Feb. 24—All motor vehicles registered in France in future are required by Government decree, published Jan. 5, 1930, to be provided with 2 independently controlled brake systems, according to advices received by the Automotive Division of the Department of Commerce from assistant automotive trade commissioner H. C. Schuette at Paris. Each of the brake systems must be capable of immediate operation and sufficiently powerful to come to an immediate standstill on the most abrupt declines.

Continental Motors Elects W. R. Angell

DETROIT, Feb. 27—At a meeting of the board of directors of the Continental Motors Corp. today, W. R. Angell was elected president of the company. He has been with the company for many years, and has served as secretary, vice-president and chairman of the Finance Committee. He brings to the office a thorough knowledge of the business in all its departments.

He succeeds R. W. Judson who has been made chairman of the board, Mr. Judson will thus be enabled to devote more time to his extensive personal interests. Roger Sherman and James H. Ferry, both of Chicago and both large stockholders in the company, have been elected vice-presidents. D. F. Tobin, Jr., is the new treasurer succeeding R. M. Sloane. Leo M. Betzel, well known Detroit attorney, was elected a director of the company at the meeting of the board of directors.

Ross W. Judson

It is under-

(Continued on page 385)

Says Air Transport Now Indispensable

F. R. Neely, of Aeronautics Branch, so Tells Illinois Manufacturers

WASHINGTON, Feb. 26—Air transport is rapidly becoming an indispensable adjunct to commerce and industry because of the need of speed in the movement of men, money, mail and merchandise, F. R. Neely, chief, Information Section, Aeronautics Branch, Department of Commerce, told a delegation from the Illinois Manufacturers' Association at a meeting here on Friday of last week.

"At the present time," Mr. Neely said, "scheduled air-transport planes fly approximately 90,000 miles each day and this mileage is in excess of that flown in any other country of the world.

"The many epochal events of the past year have combined with a day-in-and-day-out demonstration of aviation's safety, reliability and utility. It is reasonable to believe that we shall have a transcontinental service in the near future which will carry passengers and cargo from coast-to-coast in 24 to 34 hours. Transoceanic service for both passengers and cargo are also within the realm of possibility."

The Aeronautics Branch is assisting in this development, according to Mr. Neely, by the inspection, licensing and identification of aircraft; examination and licensing of airmen; establishment and enforcement of air traffic rules and regulations; establishment and maintenance of civil airways and equipping such airways with suitable intermediate landing fields, beacon lights, radio apparatus and other aids to aerial navigation; encouragement of municipal airport construction; rating of airports, and in many other ways.

Miller Predicts Sound Future

TOLEDO, Feb. 26—The next two months will show more nearly normal conditions in the automotive industry, according to Linwood A. Miller, president of Willys-Overland, in a talk to the Toledo Automotive Trades Association at a luncheon meeting this week. He said there is much better understanding between manufacturers and dealers which will result in improved efforts in sales and production this year.

Men of the Industry and What They Are Doing

G.M. Export Movements

D. A. Smith, recently appointed assistant to the managing director of General Motors Australia, and Cleveland Nickerson, production manager of General Motors Australia, Brisbane branch, sailed for Brisbane recently on the S. S. *Sonoma*. Among other movements of General Motors Export Co.'s executive personnel was the return this week of Carl Getz, director of publicity for the Export company, from a six months' tour of the plants in the Far East.

A. Wescott, assistant general service manager in charge of parts of General Motors Export Co., has sailed to attend the European Regional Parts Managers Conference in Antwerp, March 10 to 15, after which he will visit General Motors operations in Madrid, Berlin, Copenhagen and Antwerp. W. L. Morrison, who has been engaged in production work at General Motors Argentina, Buenos Aires, and General Motors Brazil, Sao Paulo, for the past two and a half years, returned to New York recently on the S. S. *Van Dyk*.

R. Langborg, general inspector of General Motors Nordiska, has sailed for Stockholm after attending the foremen's training course at the Institute of Technology in Detroit. R. Wojciechowski, assistant production manager of General Motors Polsce, who also has been attending this course, sailed for Warsaw on the S. S. *America*.

Belford Returns to Flint Agency

DETROIT, Feb. 24—Ben Belford, former general manager of the Flint Oakland-Pontiac Co., has returned to his old position and again is at the head of the Flint Oakland-Pontiac agency, it was announced yesterday. Mr. Belford is a veteran automobile man in local circles and was with the Flint Oakland-Pontiac for many years before his resignation last July.

Eldridge and Smith Return

C. E. Eldridge, sales manager of the Reo Motor Car Co., and E. A. Smith, assistant sales manager in charge of branch operations, have returned to the factory following a tour through the middle and far west, which has extended since the Chicago Automobile Show.

Federal Truck Appoints Two

DETROIT, Feb. 24—Federal Motor Truck Co. has announced the appointment of Scott C. Hannah as district manager for the north central section of the country, and M. J. Oswald as national sales representative for the New York City area.

Oakland Promotes—

C. B. Stiffler

DETROIT, March 1—A. R. Glancy, president of the Oakland Motor Car Co., Pontiac, Mich., has announced the appointment of C. B. Stiffler, former Oakland comptroller, to the newly created position of assistant to the president. Mr. Stiffler is succeeded as comptroller by his former assistant, Dale E. Williams.

Mr. Stiffler joined General Motors in 1919, after two years of army service, and served as accountant, later chief accountant and also was on the General Motors comptroller's staff. He went to Oakland as comptroller in December, 1926. Prior to the War, he was with the Indiana Union Traction Co.

Dale E. Williams

Mr. Williams joined Oakland in July, 1921, as assistant factory accountant. Successively he became factory accountant chief accountant, and assistant comptroller. In August, 1916, he joined the Chevrolet Motor Co., after some experience in banking. He remained in the accounting department of the Chevrolet home office until 1920 when he assumed charge of Chevrolet accounting in the Buffalo zone, and the following year he joined Oakland.

J. H. Otis

J. H. Otis, formerly assistant service manager for Oakland, has been appointed to the newly created post of service promotion manager in charge of service promotional and educational activities, according to an announcement by J. S. O'Rourke, parts and service manager.

Tinius Olsen is Honored

PHILADELPHIA, Feb. 26—Tinius Olsen, who recently retired as president of the Tinius Olsen Testing Machine Co., was honored last night when the city of Kongsberg, Norway, made him its first honorary citizen. The presentation of the scroll of citizenship to his birthplace was made by the Hon. Matthias Moe, Norwegian consul.

Mr. Olsen is building and has endowed what is expected to be one of the finest technical schools in Europe in Kongsberg, which is situated in the center of the silver mining district. He was decorated by the King of Norway in 1927 and in 1928 the citizens of Kongsberg erected a monument commemorating his engineering achievements and philanthropy.

He is a member of the American Society for the Advancement of Science, the society for the promotion of Engineering Education, the Internation and the American Society for Testing Materials and the Engineers' Club of Philadelphia. Last December he was succeeded as president of the company he founded by his son, Thorsten Y. Olsen.

Dumas Is Injured

Paul Dumas, editor of the Book Department, Chilton Class Journal Co., and member of the National Technical Committee of the A.A.A., is recovering from concussions and lacerations incurred in an automobile accident in which his car was completely demolished. It is understood that a truck proceeding in the opposite direction clipped Mr. Dumas' front axle, causing the car to swerve into the oncoming traffic lane, where it crashed, head on, into another truck.

Hudson Sails South

Richard G. Hudson, export manager of Reo Motor Car Co., and Mrs. Hudson sailed recently for a trip which will include visits to Panama and several countries of South America. They plan to visit the West Indies before returning to New York about April 1.

Day-Nite Elects Ricker

At the annual stockholders meeting of Day-Nite, Inc., builders of headlight testing equipment, the following officers were elected for the ensuing year: Chester S. Ricker, president; E. J. Lehnen, vice-president and secretary, and S. A. Perkins, treasurer.

Duesenberg Names Bush

C. L. Bush, formerly auditor for Auburn, has been named treasurer of Duesenberg, Inc., at Indianapolis, Ind. He has been succeeded at Auburn by Jack Beatty, formerly assistant treasurer of Stutz.

Exports, Imports and Reimports of the Automotive Industry for January of Current Year, and for January, 1929

	Month of January				Six Months Ending December			
	1929		1930		1928		1929	
	Number	Value	Number	Value	Number	Value	Number	Value
EXPORTS								
Automobiles, parts and accessories	..	$45,836,325	..	$29,097,862	..	$251,517,928	..	$200,344,048
Electric trucks and passenger cars	6	9,546	7	12,627	58	79,558	77	107,729
Motor trucks and buses except electric (total)	13,032	7,963,721	12,867	7,617,086	79,820	50,495,965	94,059	50,292,341
Up to 1 ton inclusive	9,569	4,043,250	8,856	3,991,810	59,537	27,962,649	76,127	31,643,552
Over 1 and up to 2½ tons	3,186	3,176,381	3,751	2,994,330	18,774	18,742,589	16,447	14,948,964
Over 2½ tons	277	744,090	269	630,946	1,509	3,790,727	1,485	3,699,825
PASSENGER CARS								
Passenger cars except electric (total)	24,633	17,872,115	15,293	11,073,643	173,975	123,315,231	119,834	83,097,133
Low price range $1,000 inclusive	17,665	9,153,803	10,810	5,568,017	128,425	66,192,272	86,242	43,120,943
Medium price range $1,000 up to $2,000	6,154	6,810,979	3,894	4,101,756	40,101	44,394,885	29,855	31,311,116
High price range over $2,000	814	1,907,333	589	1,403,870	5,449	12,728,074	3,737	8,665,074
PARTS, ETC.								
Parts, except engines and tires	..	..	..	..	..	..	..	..
Automobile unit assemblies	..	11,716,786	..	5,018,916	..	32,776,030	..	34,263,134
Automobile parts for replacements (n.e.s)	..	6,617,287	..	4,462,307	..	..	..	25,770,807
Automobile accessories	..	778,547	..	540,627	..	4,572,656	..	3,834,946
Automobile service appliances (n.e.s.)	..	509,506	..	760,018	..	3,542,009	..	3,664,818
Trailers	78	52,351	61	57,826	504	254,065	514	231,106
Airplanes, seaplanes and other aircraft	20	294,392	17	274,189	76	818,899	153	2,238,126
Parts of airplanes, except engines and tires	.	57,098	..	198,318	..	713,149	..	1,218,683
BICYCLES, ETC.								
Bicycles	539	14,755	420	12,649	2,485	63,656	3,448	69,491
Motorcycles	1,713	389,646	1,321	305,384	8,496	1,981,156	5,352	1,250,043
Parts and accessories, except tires	..	83,053	..	110,463	..	740,298	..	535,448
INTERNAL COMBUSTION ENGINES								
Stationary and Portable								
Diesel and Semi-Diesel	98	94,355	34	111,999	617	715,788	455	631,211
Other stationary and portable:								
Not over 10 hp.	2,745	229,742	2,912	225,546	21,631	1,756,477	16,142	1,350,282
Over 10 hp.	287	223,362	388	205,008	2,935	1,271,576	1,993	1,204,247
Automobile engines for:								
Motor trucks and buses	1,616	153,431	165	43,087	9,203	920,845	1,325	245,280
Passenger cars	6,346	704,558	2,492	250,729	38,170	4,112,092	20,492	2,224,687
Tractors	43	20,086	8	2,740	415	146,294	386	164,510
Aircraft	33	161,203	25	100,748	114	444,459	143	545,415
Accessories and parts (carburetors)	..	292,076	..	420,215	..	1,552,194	..	1,901,641
IMPORTS								
Automobiles and chassis (dutiable)	57	109,311	37	49,479	346	654,927	462	548,187
Other vehicles and parts for them (dutiable)	..	160,140	..	21,766	..	356,564	..	755,792
REIMPORTS								
Automobiles (free from duty)	25	56,936	18	13,118	132	148,124	203	295,945

Truck Group Adds Members

NEW YORK, Feb. 24—The Motor Truck Association of America held its annual dinner at the Hotel Astor here last week. About 600 members and guests were in attendance at this affair.

It was announced during the course of the dinner that the recent membership drive, which had lasted since the beginning of the year and closed the day previous to the meeting, resulted in the addition of 105 new members, bringing the total membership nearer the goal set for the year of 1000 members. Prizes were distributed to those who were successful in the membership campaign.

Hayden-Stone to Participate in Merger

DETROIT, Feb. 24—Haystone Securities Corp. affiliated with Hayden-Stone & Co., bankers, will purchase 33,000 shares of stock in the Ex-Cell-O Aircraft & Tool Corp. for cash, providing plans for the merger of the company with the Airparts & Tool Corp. is approved by the stockholders. A meeting of the stockholders of the Airparts & Tool Corp. has been called for March 6, for action on the offer of Ex-Cell-O to obtain the Airparts Co. through an exchange of stock.

No public offering is contemplated in connection with this purchase.

Met Section Hears Dickinson

NEW YORK, Feb 24—H. C. Dickinson, chief of the Heat and Power Division of the Bureau of Standards in Washington, described the work of the various units in the bureau last week to the members of the Metropolitan Section of the Society of Automotive Engineers at its regular meeting. Dr. Dickinson illustrated his talk with the use of the Cinekodak and slides. The meeting was rather poorly attended owing to the fact that many of the members of the Met Section are in St. Louis attending the aviation show there.

Extend Minerva Agreement

PARIS, Feb. 11—The working agreement which has existed for some time between the Minerva Automobile Company of Antwerp, Belgium, and the automobile section of the F. N. Company, of Herstal, has been extended. These two firms are now preparing the production of a 15 hp. car having many parts in common. The engine and the radiator will be different for the two makes, but a large number of the chassis parts will be the same, some of them being manufactured in the Minerva factory and some in the F. N. works. These two firms at present have a common purchasing organization.

Hupp Shipping New Model

DETROIT, Feb. 24—The Hupp Motor Car Corp. is now shipping to distributors and dealers its new five-passenger body model known as the Victoria coupe. It is available on both the Model C and Model H chassis. Among the features is a luggage compartment under the rear deck, access to which is provided from within the car.

Evans in Jacksonville

DETROIT, Feb. 24—Edward S. Evans, president of Detroit Aircraft, is on a short visit to Jacksonville, Mississippi, for a rest. He is expected to return to Detroit in about two weeks.

Dodge Boat Adds Dealers

NEW YORK, Feb. 24—The Horace E. Dodge Boat and Plane Corp. has issued franchises since Jan. 1 to more than 40 distributors and dealers throughout the United States, Bolivia, Denmark and Sweden. The list includes a large number of firms and individuals now or formerly engaged in the distribution of automobiles. Where these distributors are still merchandising motor cars, they are setting up entirely separate organizations to sell and service Dodge boats. Lycoming Motor Co. has set up a rigid schedule of deliveries of 4200 engines during 1930 for which the Dodge company has contracted.

Stinson Adds Dealer Contracts

ST. LOUIS, Feb. 22—Fifty new dealer contracts have been completed by the Stinson Aircraft Corp., at the International Aircraft Exposition here, from three times that many applications, and, according to W. A. Mara, vice-president of the corporation, commitments of approximately $500,000 are indicated in orders received at the show.

G. M. Japan Adds Taxi Model

NEW YORK, Feb. 24—General Motors Japan has constructed a special Chevrolet town car for use in city taxi operation. The construction of this five-passenger town car taxi has been made possible at a list price below the standard Chevrolet sedan through utilization of standard touring car body parts.

Ampco Twist Drill Co., Jackson, Mich, has announced that 1929 was the company's most successful year and it is now operating on a capacity schedule.

Financial Notes

Worthington Pump & Machinery Corp. and subsidiaries report net income for 1929 after all charges of $2,529,356. This compares with $974,000 in 1928.

Bellanca Aircraft Corp. reports net loss for the year 1929 of $109,149. Net sales during the year amounted to $564,168. Unfilled orders as of Dec. 31 totaled $598,000.

Mack Trucks, Inc., and subsidiaries report net profit for 1929 after all charges of $6,841,068. This is equivalent to $9.05 a share on common stock and compares with $5,915,301, or $7.83 a share, on the same basis for the previous year.

Bohn Aluminum & Brass Co. has declared regular quarterly dividend of 75 cents payable April 1 to stockholders of record March 14.

Federal Motor Truck Co. has declared regular quarterly dividend of 20 cents payable April 1 to stockholders of record March 17.

United Carbon Co. has declared regular quarterly dividend of 50 cents on common and semi-annual of $3.50 on preferred, both payable April 1 to stockholders of record March 15.

United Aircraft & Transport Corp. has declared regular quarterly dividend of 75 cents on preferred, payable April 1 to stockholders of record March 10.

Commercial Credit Co. reports net income applicable to common stock for the year 1929 of $4,496,807, as compared with $2,772,800 in 1928. This is equivalent to $4.48 a share on average common stock outstanding and compares with $4.01 per share in 1928.

Eaton Axle & Spring Co. in a preliminary report for the year 1929 shows net profit of $1,507,706 after all charges. This is equivalent to $5.02 a share and compares with profits of $1,429,054, or $5.49 a share, on stock outstanding at the end of 1928.

Kelly-Springfield Tire Co. reports net loss for 1929 of $1,346,417. This compares with a deficit of $2,490,513 for 1928.

Budd Wheel Co. has declared regular quarterly dividend of 1¾ per cent or $1.75 on the seven per cent preferred stock and an extra dividend of ¾ per cent on the 75 cents on the same stock.

Timken-Detroit Axle Co. reports net profit for 1929 after all charges of $1,513,029. This is equivalent after preferred dividends to $1.28 a share on its $10 par value common stock and compares with earnings of 1,738,337, or $1.77 a share, for the preceding year.

Raybestos-Manhattan, Inc., has declared income for 1929 of $3,206,293 after all charges, including inventory write-offs. This is equivalent to $4.24 a share on capital stock soon to be outstanding and compares with consolidated net earnings of $2,465,585 for the component companies during 1928, or the equivalent of $3.64 a share on a comparable basis.

Budd Wheel Co. reports sales for January of $1,172,923, or practically double the amount done in December, 1929. It is estimated that February sales will exceed January's total by a very substantial margin.

Autocar Co. and subsidiaries report net profit for 1929 of $960,045 before Federal taxes. This is equivalent after Federal taxes and preferred dividends to $5.20 a share on new no par stock created in the last quarter, and compares with net of $570,369, or $3.37 a share, on the same basis for the preceding fiscal year.

Perfect Circle Co. stockholders will be called upon to vote on March 3, at their annual meeting, on an increase of capital stock from 162,500 shares to 250,000 shares. The new stock will be available for issuance later in connection with additions to property and acquisition of additional properties.

International Harvester Co. has declared regular quarterly dividend of 62½ cents, payable April 15 to stockholders of record March 20.

Raybestos-Manhattan, Inc., has declared regular quarterly dividend of 65 cents, payable March 15 to stockholders of record Feb. 28.

Evans Auto Loading Co., Inc., and subsidiaries, has reported net income for the year ended Dec. 31, 1929, after all charges including Federal taxes, of $802,399 or $3.28 per share on the 244,494 shares of stock outstanding. This compares with net profit of $760,050 in 1928.

McCord Radiator & Mfg. Co. and subsidiaries has reported for the year ended Dec. 31, 1929, net profit of $618,490, after all charges and Federal taxes, against profit of $746,497 in 1928.

Michigan Steel Corp. net income set a new high record in the year ended Dec. 31, 1929, at $1,652,280 after all charges including depreciation, interest and taxes, equal to $7.63 a share on the 216,520 outstanding at the end of the year. This compares with $1,049,902 or $4.77 a share on 220,000 shares in 1928, heretofore the record year.

Builds Aluminum Tank Truck

MILWAUKEE, Feb. 26—Cooperating with engineers of the Aluminum Co. of America, the Heil Co., Milwaukee, maker of motor truck tank body and hoist equipment, has just completed the first all-aluminum tank truck for transporting gasoline and oil. The tank proper weighs 1800 lbs., as against a weight of 3600 lbs. for a steel unit of equivalent capacity.

Forms Credit Subsidiary

NEW YORK, Feb. 27—Kemsley, Millbourn and Co., Ltd., foreign affiliate of Commercial Credit Companies, has established the Compania Cubana Kemsley Millbourn, a subsidiary, for the handling of time sale business in Cuba, according to R. R. Appleby, president, who has just returned to this country after an extensive trip between Commercial Credit's foreign office.

Underwriters Change Rate Schedules on Motor Cars

Revision Extends Minimum on Property Damage

NEW YORK, Feb. 26—The National Bureau of Casualty and Surety Underwriters has just put into effect a number of changes in rate schedules, and in policies adopted for the establishment of rates. Among the changes in policy is the extension of the standard amount of property damage insurance in case of automobile accident to $5,000 instead of $1,000 as heretofore. In line with this change, the rate on excess property damage policies has been adjusted to the new standard rather than the old standard. The minimum age on which standard policies can be taken has been reduced from 16 to 14 years.

The rate on interurban trucking risks has been changed so that the owner now pays the rate of the highest territory through which the line lies rather than an average of the various rates applying between starting point and terminal.

Rates for garages in New York, New Jersey and California have been adjusted to give the coverage required under the recently adopted financial responsibility laws and to enable the garage owner to be protected for his employees as well as for himself.

Overland Shifts Field Men

TOLEDO, Feb. 26—Closer contact between field forces and home executives is seen in the announcement of promotion of three regional sales managers of Willys-Overland to assistant sales managers, announced by George M. Graham, vice-president in charge of sales. G. V. Orr, northwest regional sales manager, Kansas City, has been made assistant to P. C. Gartley, general sales manager of the western division, and Claude H. Paxton, New York, eastern regional sales manager, is the new assistant to N. A. Beardsley, general sales manager of eastern division. Regional lines are erased in this new policy. Each man continues with headquarters in same city, but activity is not limited to the old region, Mr. Graham says.

Russia Gets Giant Press

TOLEDO, Feb. 26—The largest metal press ever built left Toledo on Tuesday bound for Russia, where it will be used to press out side rails for trucks for the Russian government. The press was built by the Toledo Machine and Tool Co. and weighed 850,000 lb. It took 15 freight cars to convey it to New York for shipment to Archangel.

Smith Corp. Books Henney Order

MILWAUKEE, Feb. 24—A repeat order calling for 400 pressed steel frames for ambulances and hearses has been received by the A. O. Smith Corp., Milwaukee, from the Henney Motor Co., subsidiary of Allied Motor Industries, Inc., for delivery within the next four months, it is announced.

Motor Wheel 1929 Income Was Above 1928 Figure

But Earnings Per Share Showed Slight Decrease

DETROIT, Feb. 25 — The Motor Wheel Corp., Lansing, Mich., in its recent annual statement, has reported a net profit of $3,479,664 for the year ended Dec. 31, 1929, after charges including Federal taxes. This is equivalent to $4.22 a share on the 825,000 no par value shares outstanding and compares with $2,915,044, or $4.24 a share on the 687,500 shares in 1928.

Net operating profit after ample provision for depreciation and reserve, but before Federal taxes, amounted to $3,906,164, according to the statement to the stockholders by H. F. Harper, president.

During the past fiscal year approximately $700,000 was expended in fixed assets, most of which was the completing of the increased production program started the previous year. The company's fixed assets, however, after liberal depreciation policy, show an increase of $168,604, as compared to the previous year. The corporation continues its financial condition with a ratio of current assets to liabilities of better than seven to one.

Out of net earnings for the year the sum of $1,984,833 was paid in cash dividends on common stock. Also the sum of $1,375,000 was transferred to capital stock account, representing the 20 per cent common stock dividend of 137,500 shares distributed in October, 1929. These two items amount to $3,359,833.

Continental Motors Elects

(Continued from page 381)

stood that other changes in the directorate and staff are contemplated in the near future. The changes in the personnel were the result of a harmonious understanding between all the parties interested, and the new president was assured of the united support of the entire organization. Upon taking office the new president said:

"It is the object of the new management to practice strict economy in all departments, to develop new outlets for the company's various products and to meet the requirements in every particular of an exacting purchasing public.

"The company has nearly 30,000 stockholders. These and the company's customers will be our first consideration. Never before in the history of the automobile industry has there been a better opportunity for the independent engine builder. While competition is keen our company is certain to have its full share of the new business which is developing so rapidly, particularly in the industrial field. Our airplane engine is proving a great asset to the industry and our facilities for manufacturing it are being fully rounded out.

Holds Motor Boats Gain From Traffic

TRENTON, N. J., Feb. 25— Crowded highways are causing many people to turn to motor boats in summer, and as the automobile resulted in good roads, so will the motor boat bring improved waterways, according to the president of the New Jersey Board of Commerce and Navigation, J. Spencer Smith. The number of motor boats in New Jersey increased 20 per cent last year, two and one-half times the rate for automobiles, and 15,372 boats now are registered. He urges that the Legislature set aside 3 per cent of the gasoline tax to deepen channels. This would produce about $300,000 instead of the $90,0000 now received by the board, he said.

Budd Elects Officers

PHILADELPHIA, Feb. 26—At a meeting of the directors of the Edward G. Budd Mfg. Co. last week, the following officers were elected: Edward G. Budd, president; Donald Alexander and William J. Meinel, vice-presidents; H. A. Coward, secretary; Paul Vens, treasurer; C. W. Messenger and Edward C. Dessalet, assistant treasurers.

Directors of Budd Wheel Co., at a meeting last week, elected the following officers: Edward G. Budd, president; Donald Alexander, vice-president; H. A. Coward, secretary; Paul Vens, treasurer, and C. W. Messenger and Edwin C. Dessalet, assistant treasurers.

Steel Plant Gets Option

DETROIT, Feb. 27—The American Rolling Mills Co. has obtained an option on a 230-acre site at Sibley, Mich., near Detroit, and is considering the construction of a complete steel manufacturing unit there, according to reports from New York. The option expires April 14.

Hudson Plans Challenger Week in Essex Promotion

Will Spend More in Newspapers Than Last Year

DETROIT, Feb. 25 — "Aggressive merchandising and advertising will play a big part in restoring sound business in which everybody will profit," stated Chester G. Abbott, general sales manager of the Hudson Motor Car Co., in announcing that his company will spend more in newspaper advertising during Essex Challenger period than it did last year, the biggest in the history of the company.

"This country showed the rest of the world that sound merchandising was essential to prosperity and other countries have followed our example. In staging Essex Challenger Week, March 2 to March 9, we are using the newspapers more extensively than last year because we believe that business is there for the company that goes after it," says the Hudson executive, who predicts that Challenger Week will be a big success.

The Hudson Motor Car Co. was the largest user of newspaper advertising at the automobile shows in New York, Chicago and other centers. It is the second largest independent in the automotive field and has been noted for its aggressiveness as well as the quality of its products.

Outboard Expects Good Year

MILWAUKEE, Feb. 25—Advance orders indicate that the three divisions of the Outboard Motors Corp., Milwaukee, will exceed the aggregate sales of the Evinrude, Elto and Lockwood units during 1929, it was stated following the quarterly meeting of directors. Since a year ago, the Evinrude factory has been enlarged to accommodate both the Elto division, formerly occupying its own plant at Milwaukee, and the activities of the Lockwood division at Jackson, Mich.

Rubber Invoiced to U. S.

WASHINGTON, Feb. 25—American consular officers at Singapore, Penang, Colombo, Batavia, Surabaya, Medan, London and Liverpool, who vise invoices on all rubber shipped to the United States from Malaya, Ceylon, Netherland East Indies, and the United Kingdom, report by cable the following amounts of rubber invoiced during the week ended Feb. 22, 1930, as compared to amounts invoiced in 10 preceding weeks:

1929 Week Ended	British Malaya	Ceylon	Netherland East Indies	London and Liverpool	TOTAL
Dec. 14	7,428	1,299	1,655	6	10,388
Dec. 21	7,599	1,953	2,003	22	11,577
Dec. 28	4,943	364	1,856	5	7,168
1930					
Jan. 4	8,067	1,587	2,419	51	12,124
Jan. 11	7,235	931	1,469	15	9,650
Jan. 18	7,009	898	1,560	49	9,516
Jan. 25	9,212	1,103	2,051	14	12,380
Feb. 1	5,078	1,213	1,679	98	8,068
Feb. 8	9,902	1,788	2,572	31	14,293
Feb. 15	7,223	1,312	1,315	59	9,909
Feb. 22	7,010	1,223	2,389	51	10,673

All figures in long tons.

Mill Operations Show Tendency to Increase

Automobile Sheet Production Assuming Greater Importance

NEW YORK, Feb. 27—Aside from minor fluctuations, steel mill activity is not only well maintained, but continues to show a rising tendency in most finished products. Chicago district rolling mills fared so well in sheet order bookings during the first half of February that the possibility of price advances came in for much discussion, Western producers having looked upon going sheet prices as unsatisfactory for a long time.

While order books of Mahoning Valley rollers are showing steady improvement, the point has not yet been reached where backlogs would give support to upward price revision. It is an open secret that, although the general run of business carries full prices, large buyers are accorded slight concessions on attractive commitments. Automobile sheet production in the Detroit district is assuming greater importance, and among the week's interesting developments is a report that an important Ohio producer has secured an option for a Detroit River site for the erection of a $20,000,000 plant to supply automotive steels.

Detroit, therefore, is slowly developing from its present status of a leading consuming and distributive market into a steel production center. Demand for strip-steel continues along unchanged lines, orders for cold-rolled being still subnormal. Manufacturers says, however, that inquiries received during the last few days indicate that considerable business overhangs the market and is likely to come through in March. Inquiry for cold-finished steel bars is good. Chicago district bar mills are booked for the current quarter to the extent of their capacity. The hot-rolled steel bar market is firm. Demand for automotive alloy steels is slowly broadening.

Pig Iron—Routine conditions prevail in most of the markets. Prices are well held. A good deal of the demand is for small lots, indicating a continuance of hand-to-mouth buyings. Quotations are entirely unchanged.

Aluminum—A slight increase in demand for foundry metal from automotive consumers is noted. About the only direct result of the proposed lowering of the tariff rate has been the flooding of the scrap market. Dealers who had been holding heavy tonnages pending an improvement in the market are liquidating their holdings as much as possible. The market for virgin metal is unchanged.

Copper—Domestic consumers show scant interest in offerings. There is a disposition to await end-of-the-month statistics before covering more than immediate needs. In the "outside" market, producers' prices are shaded a fraction, but the supply of metal in resellers' hands is very limited.

Tin—The general impression is that February statistics will add to the visible supply, and that curtailment of output will not be felt for some time.

Attention is Drawn to Stolen Car Loss

WASHINGTON, March 1—Estimating that 300,000 automobiles are stolen annually in the United States and that the unrecovered cars result in a national loss of $20,000,000, Thos. P. Henry, President of the American Automobile Association, has called the attention of the National Commission on Law Observance and Enforcement to the part stolen cars are playing in crime conditions throughout the country.

French Production Gains

PARIS, Feb. 12—French automobile production for the year 1928 is given at 223,600 units, exclusive of Ford assemblies. This total comprises 78 per cent passenger cars, 18 per cent light trucks, and 4 per cent heavy trucks. Among the passenger cars 80 per cent had a rating of 10 hp. or less, and 18 per cent had 6-cylinder engines. Closed cars were in an immense majority with 58 per cent of the total production; open cars were responsible for 20 per cent of the total.

Estimates for the year 1929 are a total of 255,000 automobiles, exclusive of Ford assemblies. Of this number 53,000 were exported and 202,000 were absorbed by the home market. The three leading producers were Citroen, Renault, and Peugeot, followed by Ford assemblies. Production during the first nine months of the year was very satisfactory, but the last three months were dull.

Joseph H. Bragdon

NEW YORK, Feb. 24—Joseph H. Bragdon, vice-president and general manager of the Bragdon, Lord & Nagle Co., division of the McGraw-Hill Publishing Co., died suddenly of pneumonia, Feb. 19, at his home in New Rochelle, N. Y. Mr. Bragdon was a member of the executive committee and of the board of directors of the McGraw-Hill Publishing Co. He was past president of the New York Business Publishers Association and a past president of the Associated Business Papers, the latter office being the highest honor which the business publishing profession can offer. At the time of his death he was a member of the board of governors of the Advertising Federation of America.

Increases Glider Production

DETROIT, Feb. 24—With gliding gaining such an added interest, the production of the "Gull," a primary glider built by the Gliders Division of Detroit Aircraft, has been increased from 100 to 200 as an initial factory order. The Philadelphia Airways recently ordered 50 and the St. Louis Glider Club, headed by H. D. Kuchins, five. Mr. Kuchins is now developing the World's first Gliderport near St. Louis.

Equipment Index Gained Over December's Figure

But Was Below January of Last Year, M. & E. A. Says

NEW YORK, Feb. 25—Manufacturers of original equipment showed a marked increase in January as compared with December, but fell short of January a year ago, according to the monthly index figures prepared by the Motor and Equipment Association. It is indicated that car manufacturers cut their commitments to a minimum during December, anticipating model changes, and that as a result their stocks became depleted during January and January sales in this group amount largely to the improving stock condition.

This is partly due also to an anticipated advance in car production for the month of February. The index for original equipment for January, based on January, 1925, as 100, was 135, which compares with 34 in December and with 212 in January a year ago.

Service parts index for January was 137 as compared with 132 in December and 141 in January of 1929. Accessories are the only group which showed a decline when compared with December, setting an index of 79 as compared with the December index of 90 and an index of 77 for January a year ago. Service equipment index for January was 135 as compared with 119 in December and 173 in January of last year. The grand index for all groups thus becomes 132 as compared with 52 in December and 188 a year ago. Wholesalers' sales during January set an index of 106, taking January 1928 as 100, and compares with 128 in December and 114 in January a year ago. Accounts receivable show a marked decrease from December and are also considerably below January of last year.

Budd Wheel Sales Gain

PHILADELPHIA, Feb. 25 — The Budd Wheel Co., Philadelphia and Detroit, announces that its sales for the month of January were $1,172,922.91. This practically doubles the December sales and indicates a return to large volume production. It is estimated that sales for February will exceed those of January by a very substantial margin.

Autocar Gets Russian Order

ARDMORE, PA., Feb. 24—The Amtorg Trading Co., New York, has bought 69 heavy-duty Autocar trucks for export to Russia, according to the announcement of H. M. Coale, vice-president of the Autocar Company, here today. The order calls for immediate delivery.

Delage in Endurance Run

PARIS, Feb. 11—Demonstrating the speed and endurance of the new straight eight 247 cu. in. Delage, Robert Senechal accomplished a journey of 4200 miles in eight consecutive days, passing through ten European capitals.

Eaton Axle is Merged With Wilcox-Rich Corp.

Combined Assets of Both Are More Than $19,000,000

DETROIT, Feb. 24—A plan for the consolidation of the Eaton Axle & Spring Co. and the Wilcox-Rich Corp. has been approved by the directors of the companies, according to a joint announcement by J. O. Eaton, chairman of the board of Eaton Axle and Carlton Higbie, chairman of the board of Wilcox-Rich. The plan contemplates exchange of Eaton Axle capital stock for Wilcox-Rich "A" and "B" shares, although the exact ratio of exchange as proposed has not been revealed. Stockholders of both companies are to act on the project at an early date.

Simultaneously Eaton Axle announced the acquisition of the Peterson Spring Co., of Detroit, maker of valve and brake springs, about half of the production of which is sold in the automotive field.

The balance sheets of Wilcox-Rich and Eaton Axle, as of Dec. 31, 1929, show combined assets of more than $19,000,000, while combined net earnings for the year 1929 were more than $2,900,000.

Wilcox-Rich has four plants located in Detroit, Saginaw, Battle Creek and Marshall, Mich. It is engaged in the manufacture of valves, tappets, piston rings and other parts pertaining to gasoline motors, automobiles, airplanes and trucks. It also manufactures pump shafts, clutch levers, piston rods, Rich "Red-Head" rivet set for special steel work, and other forged parts and special tools. Its customers include practically all of the large automobile manufacturers as well as manufacturers of airplanes, tractors and marine, industrial and Diesel engines.

Merger of Wilcox-Rich with Eaton Axle fits into the latter company's program for expansion and diversification of its products. Eaton Axle, with three plants at Cleveland, and additional plants at Massillon, Ohio, and Detroit, manufactures axles, springs, bumpers, heaters and caps (for gasoline tanks, radiators, etc.), for trucks, buses and automobiles, and have just announced the acquisition of the Peterson Spring Company of Detroit, makers of coil springs, such as valve springs, brake springs, die springs and lock springs for the automotive and other fields.

Steel Founders Seek Arbitration

NEW YORK, Feb. 24 — The Steel Founders' Society of America, Inc., has recommended to its members that an arbitration clause be incorporated in their purchase and sales contracts. This society, at a recent meeting of the board of directors, voted to enter into a cooperative arrangement with the American Arbitration Association which would provide that the latter's facilities would be available for the society's members.

1929 Car Output Gains in Hungary

WASHINGTON, Feb. 24—A total of 883 motor vehicles, including 381 cars, 62 trucks, 189 buses and 251 motorcycles, were manufactured in Hungary during 1929, according to advices received by the Automotive Division of the Department of Commerce from Assistant Trade Commissioner Walter M. Slavik at Budapest.

Output during 1928 numbered 873 vehicles, so that the increase during 1929 was slight; however, production last year amounted to 14½ per cent of consumption, or estimated sales, as compared with only 12 per cent the year before.

Ford of Canada Gains

DETROIT, Feb. 24—Production by the Ford Motor Co. of Canada, Ltd., has been gradually increased since the introduction of the new Ford body lines on Dec. 31. On Feb. 1 the plant at East Windsor went on a five-day-week schedule and has maintained a production of approximately 400 passenger cars per day. Production on the new trucks has just been started.

W. R. Campbell, president of the company, said: "Our production program for this year has been worked out to parallel dealer requirements. Dealer inventories are unusually low and as our best selling season begins shortly, we are arranging production to give dealers the quantity of cars they will require for spring delivery. At present our production is approximately 400 units a day and the plant is operating on a five-day week. We are attempting this year to stabilize employment by distribution of production over a longer period of time."

Stinson Production Increased

DETROIT, Feb. 24—Production of planes by the Stinson Aircraft Corp., Wayne, Mich., has been increased 210 per cent during the past ten days and a further increase is expected, officials said today. Instructions have been received from Edward A. Stinson, president, now in St. Louis, to increase production on the tri-motored ten-place airliner transport which would not have been ready for delivery under the former schedule until about May 1.

The goal of 200 planes in the first three months of 1930 will be considerably surpassed, it is indicated through orders received at the International Aircraft Exposition at St. Louis.

AC Adds 12 Plugs to Line

DETROIT, Feb. 24—Twelve new long life spark plugs in ⅞ in. regular and metric sizes for heavy duty service have just been introduced by the AC Spark Plug Co. of Flint. The plugs are graded according to the new AC heat range system, which enables them to meet all engine requirements and extreme operating conditions.

Pierce-Arrow Has Profit on Operations of 1929

Net Is $2,566,111 Against Last Year's Loos

BUFFALO, Feb. 24 — The Pierce-Arrow Motor Car Co. today issued its annual report, for the year 1929, showing net profits of $2,566,111.74, as compared with losses of $1,293,025.55 sustained in the preceding year. The report covers the first complete year's operations of the company as reorganized with expanded resources under the control of the Studebaker Corp.

In the report, A. R. Erskine, president of the company and chairman of the board, states: "Net sales amounted to $27,962,857.31, as compared with $19,436,672.07 in 1928, a gain of 43.8 per cent and a record for the company. Dividends on the 6 per cent cumulative preferred stock of $352,500 were paid, commencing June 1, and the remaining net profits were added to surplus account which showed a credit of $3,306,512.93 at the close of the year.

"Some other important events of 1929 were these:

"9840 passenger cars were sold, against 5492 in 1928, a gain of 79 per cent, and 6037 in 1927, the previous record. The old line of commercial cars and trucks was liquidated and the development of a new line was begun.

"Pierce-Arrow distributors expended over $3,000,000 in buildings and equipment to handle the growing business; the number of distributors in the United States was increased from 217 to 525 and foreign connections were established on a broad scale."

Thomas H. Merrill

DETROIT, Feb. 24—Thomas H. Merrill, 25-year-old son of Thomas S. Merrill, secretary of General Motors Corp., died Feb. 20 at Tucson, Ariz., after a long illness. Merrill was born in Washington, D. C., and was educated in the Detroit public schools. At the time illness overtook him he was employed by the Fisher Body Co.

He is survived by his parents and one sister, Mrs. Marjorie Carson.

Michigan Scrapped 132,932 in '29

DETROIT, Feb. 24—A total of 132,932 motor vehicles were scrapped or put out of commission in Michigan last year, according to figures just released by the Motor Vehicle Division of the Department of State, Lansing. Total registrations in Michigan in 1929 were 1,397,672, of which number 1,220,848 were passenger cars and 176,824 were commercial vehicles.

United Aircraft Books Large Order

NEW YORK, Feb. 24—United Aircraft Exports, Inc., subsidiary of United Aircraft & Transport Corp., has just signed a contract with the Peruvian Government to sell 26 airplanes and 15 spare Pratt & Whitney engines at a total value of $850,000.

News in Brief

G. R. Rodway, European factory representative and distributor, announces that his organization is not interested in a promotion of accessories for sales through distributors.

After voting early in the winter to abandon its auto show this year, the Sioux City Automobile Dealers Association rescinded its action, and March 4 to 8 inclusive have been set for an exhibit.

"Automobiles in 1930 will be sold in numbers which are directly proportionate to the efforts expended by dealers and salesmen," according to a statement by Thomas E. Jarrard, general sales manager of Marmon.

Motor vehicles equipped with radio may not be permitted to operate on Massachusetts roads, if a ruling drafted by the State Motor Vehicle Commissioner goes into effect.

All the executive offices of the Olds Motor Works, Lansing, Mich., have been removed to a new administration building recently completed.

Billings & Spencer Co., Hartford, Conn., announces the opening of a New York office and warehouse at 53 Warren St., in charge of W. Ray Moore.

"The shock of the deflation in security prices has largely been absorbed in three months," according to a report from the National Business Survey Conference.

W. D. Beath & Son, Ltd., Toronto, Sarnia, and Montreal, Canada, plans an extensive expansion campaign for 1930. Arrangements were made recently whereby the Canadian interests of the St. Paul Hydraulic Hoist Co., the Stoughton Co., and the Perfection Body Co., were taken over by the Beath organization.

Officials of the Skinner Co., Ltd., Gananoque, Ontario, were tendered a civic reception on the occasion of the opening of a new plant. Automobile bumpers will be the chief product of the new plant.

January sales of AC products established a new record, substantially exceeding any month in the company's 22 years of operation, according to an announcement.

Curtiss-Wright Airport Corp. is preparing a series of maps showing the country surrounding various airports operated by the company, including a radius of about 300 miles.

Curtiss-Wright Sales Corp. has announced a merchandising plan which contemplates, wherever possible, awarding sales franchises to dealers who are already established as agents for some other form of automotive transportation.

Aeronautical Chamber of Commerce, is sponsoring a one-day New York State airport conference to be held at Elmira, March 5.

Norge Corp., subsidiary of Borg-Warner, announces an intensive selling campaign on a complete line of household electric refrigerators. The plan includes expansion of the whole selling organization.

A trailer requires a license fee equal to 50 per cent of that on the vehicle by which it is drawn, according to a recent ruling of the Attorney-General of Alabama.

General Tire and Rubber Co., Akron, reports that telegraphic orders for replacement stock of tires are four times as large as they were this time a year ago.

General Motors Export Co. has prepared a new motion picture film, entitled "Civilization Rides Forward," based on various writings of J. D. Mooney, president.

Export Managers Club of N. Y., Inc., will hold its annual get-together for export executives at the Hotel Pennsylvania on Tuesday, March 18.

New car registrations in New Jersey during January totaled 8067 cars, according to Sherlock & Arnold. This compares with 5063 during January a year ago.

Public Service Coordinated Transport of Newark, N. J., has purchased 180 gas-electric coaches, bringing its total to more than 1400 of this type.

Cadillac Begins Campaign

DETROIT, Feb. 24—A national drive to reduce used car stocks in its dealers' hands, beginning yesterday and extending through March 2, is being sponsored by the Cadillac Motor Car Co. The factory is assisting its dealers in the advertising of substantially lowered prices through the provision of window trims and newspaper advertising, varying in volume, according to the size of the dealer. The General Motors deferred payment plan is available in connection with each used car sale.

Wills Holders May Get Dividend

PORT HURON, MICH. Feb. 24—C. H. Wills, president of the Wills St. Claire Co., which for some time has been in the process of dissolution, has announced receipt of news from Eastern bankers that a dividend is in prospect in liquidation of the first preferred stock of the company. It is expected, he stated, to be somewhere between $6 and $7 a share and may ultimately reach $10 a share. Cash is on hand for payment of the dividend on the approximately 35,000 shares of this stock outstanding.

Ex-Cell-O Tool Acquires Airparts and Tool Corp.

Merger is to be Effected Through Exchange of Stock

DETROIT, Feb. 24—Directors of the Airparts and Tool Corp. have approved the offer of the Ex-Cell-O Aircraft and Tool Corp. to acquire the Airparts Co. through an exchange of stock. The terms offered by the Ex-Cell-O are ¾ share of Ex-Cell-O for every share of Airparts Class A stock and ½ share of Ex-Cell-O for every share of Airparts Class B stock. A stockholders meeting has been called for March 6, at which time the stockholders will vote on the merger plans.

The Airparts and Tool Corp. was organized in August, 1929, to acquire all the assets of the Wayne Tool Co. and H. R. Krueger and Co., both of which are located in Detroit. In November, 1929, the Airparts and Tool Corp. through an exchange of stock acquired the Wolverine Screw Co., also of Detroit. The Ex-Cell-O offer includes the acquisition of all these divisions.

The Wayne Tool division products are similar to those of the Ex-Cell-O corporations, consisting largely of dies, jigs, tools and special machinery, while the Krueger Co. manufactures special machinery to increase production. The Wolverine Screw Co. manufactures special parts such as rear brake camshafts, crank ratchets and special bolts made from high carbon steel.

Newton Plant Opens

DETROIT, Feb. 24—The new $8,000,000 unit of the Newton Steel Co. at Monroe, Mich., was opened this week employing some 600 men. The plant is the first unit in a program to extend over the next ten years and which ultimately will cover a 600-acre tract, situated at the River Raisin and Lake Erie, with furnaces, rolling mills and other steel works. Within the next two months it is expected that the new plant will employ between 1500 and 1800 men, turning out some 18,000 tons of steel sheets, mostly for the automobile industry. At present the raw product is steel bars, but ultimately the company plans to have its own blast furnaces on the site.

General Motors Calls Meeting

NEW YORK, Feb. 25—The General Motors Corp. has sent out a formal notice to stockholders calling for a special meeting to be held March 5 to consider and approve the General Motors Management Corp. plan outlined by the board of directors at its meeting of Feb. 6.

Studebaker Gains in New York

NEW YORK, Feb. 24—C. K. Whittaker, New York branch manager for the Studebaker Corp., reports that sales and deliveries of Studebaker and Erskine cars during January exceeded all previous records for this month in his territory.

Casing and Tube Output Dropped for 1929 Period

Rubber Manufacturers Estimate Given for Year

NEW YORK, Feb. 24—Tire manufacturers in the United States produced 73,307,562 pneumatic casings and 73,417,181 inner tubes during 1929, according to the estimate prepared by the Rubber Manufacturers Association.

These figures are based on reports received from members who are assumed to produce 75 per cent of the total for the United States. The figures compare with production of 77,943,817 pneumatic casings during 1928 and 80,179,841 inner tubes.

Shipments during 1929 are placed at 74,021,178 pneumatic casings and 75,297,737 inner tubes, as compared with 74,295,916 casings and 77,126,918 tubes during 1928.

Members of the association have succeeded in reducing their inventories during 1929 considerably. When compared with 1928 inventories at the end of December, however, they show a slight increase for balloon casings over inventories for the end of December of the previous year and an increase for high pressure inner tubes when compared with November.

Comparative figures for December, 1929; November, 1929, and December, 1928, follow:

		Inventory	Production	Shipments
Pneumatic Casings—All Types				
Dec.	1929.....	9,470,368	2,445,817	2,589,515
Nov.	1929.....	9,701,415	2,702,577	2,668,319
Dec.	1928.....	10,217,708	4,203,624	3,443,210
Inner Tubes—All Types				
Dec.	1929.....	10,245,365	2,787,121	2,723,035
Nov.	1929.....	10,275,983	2,835,314	2,783,880
Dec.	1928.....	12,087,464	3,887,971	3,643,810
Balloon Casings				
Dec.	1929.....	7,160,127	1,783,784	1,920,396
Nov.	1929.....	7,364,873	1,923,296	1,924,073
Dec.	1928.....	6,594,978	2,761,109	2,371,732
Balloon Inner Tubes				
Dec.	1929.....	6,889,213	1,940,789	1,952,450
Nov.	1929.....	6,990,953	1,745,533	1,870,927
Dec.	1928.....	7,049,748	2,453,744	2,312,203
High Pressure Cord Casings				
Dec.	1929.....	2,290,236	659,410	663,992
Nov.	1929.....	2,313,743	774,620	737,920
Dec.	1928.....	3,580,576	1,434,529	1,061,132
High Pressure Inner Tubes				
Dec.	1929.....	3,339,451	844,904	768,331
Nov.	1929.....	3,264,933	1,088,037	910,444
Dec.	1928.....	5,037,716	1,434,227	1,331,607

Plymouth Deliveries Gain

DETROIT, Feb. 24—Retail sales of Plymouth motor cars in the United States during 1929 totaled 85,704 units, according to a statement authorized by A. van Der Zee, general sales manager of the Plymouth Motor Corp.

This represents an increase of 9704 units, or 12.8 per cent over the total 1928 retail deliveries in the United States of both Plymouth and the Chrysler "52," which was the lowest-price Chrysler-built car prior to the introduction of the Plymouth in July, 1928. In the 18 months since its inception the Plymouth dealer organization in the United States has grown to number 3500 dealers.

January Production Gained Over December Figure

WASHINGTON, Feb. 27—Reflecting an increase of about 128 per cent, the production of motor vehicles in the United States in January totaled 273,089 units as against 120,004 in December, according to reports received by the Department of Commerce from 144 manufacturers. The passenger car output increased 153 per cent to 234,527 from 91,235, while the truck output increase was approximately 40 per cent, rising to 37,990 from 27,286. Taxicab production declined to 572 units from 1483.

Canadian motor vehicles to the number of 10,388 were produced in January as against 5495 in December. Passenger production was 8856 as against 4426 and truck output was 1532 as against 1069.

Ford Buys Steel Plant

DETROIT, Feb. 24—The Ford Motor Co. has purchased the plant of the United States Pressed Steel Co., Ypsilanti, Mich., on the Huron river near the south city limits, it was announced yesterday. The purchase of this plant is seen as the final step in the acquisition by the Ford interests of all land to be covered by water as a result of the dam the company will construct three miles south of Ypsilanti.

The Ford company announced some time ago that a $5,000,000 textile plant will be erected near the dam. The consideration received by the steel company has not been announced.

Henry J. Day

DETROIT, Feb. 24—Henry J. Day, 72 years, manager of the Lansing district of the Durant Motors of Michigan Sales Co., and uncle of Mrs. W. C. Durant, died Feb. 19 at the St. Lawrence Hospital in Lansing of apoplexy.

Mr. Day was a leader in the automobile industry for the last 18 years, having been district manager of Durant.

Hill-Diesel to Expand

DETROIT, Feb. 24—The Hill-Diesel Engine Co., Lansing, maker of oil-burning marine and other engines, will spend over $100,000 this spring in the purchase and installation of new equipment for its plant on Mill Street. Announcement of the appropriation for such expenditures was made last week.

Safety Committee to Meet

WASHINGTON, Feb. 26—The general meeting here of the National Conference on Street and Highway has been tentatively set for the last week in May or the first week in June by Secretary of Commerce R. P. Lamont, chairman of the conference.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries.

NEW YORK, Feb. 26—The spring-like weather last week stimulated spring business. Shipments were on a larger scale. Steel operations fell off somewhat, although in some sections of the trade there was a slight increase. The decline in the prices of wheat and cotton is considered disturbing.

INDUSTRIAL ACTIVITY

Industrial activity in January, based on the consumption of electrical energy, was 4.6 per cent above that in December and 8.1 per cent below that a year ago.

CHAIN STORE SALES

Sales of 58 store chains during January totaled $222,243,080, as against $203,177,466 during the corresponding month last year.

LUMBER PRODUCTION

Production of lumber during the week ended Feb. 8 by 213 mills, according to the West Coast Lumbermen's Association, amounted to 158,006,144 ft. Orders and shipments were 10.39 per cent and 16.18 per cent respectively below production.

FREIGHT CAR LOADINGS

Railway freight loadings for the week ended Feb. 8 totaled 886,581 cars, which marks a decrease of 69,400 cars below those a year ago and a decrease of 19,896 cars below those two years ago.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices for the week ended Feb. 21 stood at 92.2, as against 93.1 the week before and 93.4 two weeks before.

STOCK MARKET

After several weeks of rising prices, the stock market last week was marked by a severe break. The downward movement came in the middle of the week; and, while there was some recovery in the latter part of the period, most issues closed the week with net losses. The volume of trading was at about the same level as in the several preceding weeks. Call money ranged from 4 to 4½ per cent.

Brokers' loans in New York City for the week ended Feb. 19 increased $44,000,000, bringing the total up to $3,494,000,000, as compared with $5,477,000,000 a year ago.

FEDERAL RESERVE STATEMENT

The consolidated statement of the Federal Reserve banks for the week ended Feb. 19 showed a decrease of $5,000,000 in holdings of discounted bills. There were increases of $5,000,000 in holdings of bills bought in the open market, of $2,100,000 in holdings of Government securities, and of $7,800,000 in member bank reserve deposits. The reserve ratio on Feb. 19 was 78.5 per cent, as against 77.9 per cent a week earlier and 78.0 per cent two weeks earlier.

French Car Beats Field in Monte Carlo Rally

Licorne, Driven by Hector Petit, Captures Most Points

PARIS, Feb. 4—A 5-hp. 53 cu. in. Licorne, driven by Hector Petit and carrying two other persons, won the Monte Carlo rally by traveling a distance of 2186 miles from Jassy in Eastern Rumania, at the required average speed of 26¾ m.p.h. American cars secured second, third and fourth positions. These competitors were Count Berlesco on a De Soto, Blin d'Orimont on a Studebaker, and Dr. Sprenger Van Eijk on a Graham-Paige, all coming from Jassy. Jacques Bignan on Fiat and Count E. Urdarino on the same make of machine, also from Jassy, were classed fifth and sixth.

Under the rules of this competition cars had to start from distant parts of Europe selected at their own discretion and make for Monte Carlo, points being given for distance covered, for average speed, which could not exceed 26¾ m.p.h. all stops included, and finally for regularity over two rounds of a difficult 50-mile hilly circuit above Monte Carlo.

One hundred and sixteen faced the starter, and by reason of exceptionally mild weather conditions in all parts of Europe 88 of these arrived at Monte Carlo and 70 of them received maximum points for average speed. The final results, therefore, were determined by the regularity run at Monte Carlo, and so close was this that there was a difference of only one point between the first and the fifteenth competitor.

G.M. to Export Planes

NEW YORK, Feb. 24—General Motors Export Co. has sold five Super-Universal Fokker monoplanes to Mitsui and Company, Ltd., of Japan, which controls the Nakajima Aircraft Works in Japan. Arrangements have been made whereby the Mitsui company will be licensed to build these planes in its own factory in the future. This is the first sale made by the aviation department of General Motors Export Co. although there was one plane sold in South Africa through General Motors South African prior to the assumption of responsibility for aviation sales by the Export company.

Italian Motor Fuel to Contain Alcohol

WASHINGTON, Feb. 24—An Italian Royal decree of Feb. 15, effective immediately, theoretically, requires all motor fuel to contain at least 30 per cent of domestic alcohol, according to a radiogram received in the Department of Commerce from Commercial Attache M. M. Mitchell, Rome. The operation of this law depends upon ministerial regulations to be issued later.

Oil Companies to Merge

NEW YORK, Feb. 24—Directors of the Vacuum Oil Co. and the Standard Oil Co. of New York have reached an agreement on the basis for a merger of these two companies following many months of negotiation. Under the merger contract it is proposed to change the name of Standard Oil Co. of New York to General Petroleum Corp., which will exchange three shares of its capital stock for each share of Vacuum Oil Stock. Stockholders of Standard will receive one share of new General Petroleum in exchange for one share of their present stock.

Crude Rubber Active

NEW YORK, Feb. 24—Activity in crude rubber has shown a marked increase during the past week following price increases from abroad, according to F. R. Henderson Corp. These changes in price levels are predicated on the agreement which has been reached by Dutch growers to stop tapping during the month of May. It is not clear whether this agreement is predicated on the ratification of 70 per cent of the British-Dutch rubber growers' interests or not. The Henderson company believes that the suspension of tapping during May will cut production about 27,000 tons, but it is possible that net reduction during the year will be less than that as an abnormally large production may result after the month's rest. This company finds it doubtful whether world production for 1930 will be decreased more than three per cent as a result of this restriction.

General Motors U. S. Sales Gained During January

New Method of Classification Gives Domestic Figure Only

NEW YORK, Feb. 24—General Motors dealers sold to consumers in Continental United States during January a total of 74,167 cars, as compared with 73,989 for the corresponding month of 1929, according to Alfred P. Sloan, Jr., president. These figures, it will be noticed, differ from figures previously released by the corporation in that they cover sales in Continental United States rather than total sales as have been mentioned heretofore.

Sales by dealers within the United States amounted to 94,458, as compared with 95,441 in January a year ago. Special attention is called to the fact that in January a year ago dealers' stocks were abnormally low and deliveries to dealers were consequently speeded up during the early part of the year, which would account for the lower dealer delivery this year.

Total sales to dealers, including Canada and overseas, amounted to 106,509, as compared with 127,580 in January a year ago. Overseas sales were curtailed in order to adjust stocks in overseas countries as the result of adverse economic situations existing in certain markets which are important customers of automotive products.

To Make New Engine

NEW YORK, Feb. 24—Aircraft and Industrial Motors Corp. has been organized with a capital of 200,000 shares of common and 25,000 shares preferred, no par stock, to manufacture the Shubert valveless aircraft engine designed by J. Shubert, who is president of the company.

The engine is a six-cylinder, two-cycle, air-cooled engine weighing approximately 110 pounds and developing 75 horsepower at 1800 r.p.m. It is a stationary radial motor and according to the company has a fuel consumption of 0.40 lb. to horsepower hr. The engine has been block-tested for 900 hours and has been flown in an aeromarine Klemm monoplane.

At present the company has headquarters at 136 West Fifty-second Street, but plans to expand into larger quarters in the near future.

Calendar of Coming Events

SHOWS

Los Angeles, Automobile..Feb. 22-March 2
Camden, N. J., Automobile..Feb. 24-Mar. 1
Des Moines, Automobile ....Feb. 24-Mar. 1
Seattle, Wash., Automobile..Feb. 25-Mar. 2
Detroit (All-American Aircraft)..April 5-13
Asbury Park, N. J., Automobile..April 7-12

CONVENTIONS

National Management Congress, Chicago .....Mar. 3-7
A.S.M.E. Convention, Chicago .....Mar. 3
American Society for Testing Materials, Regional Meeting, Detroit .....Mar. 19
American Society Mechanical Engineers, Fiftieth Anniversary Celebration:
New York .....April 5
Hoboken, N. J. .....April 7
Washington, D. C. .....April 8-9
National Council Meeting of the U. S. Chamber of Commerce, Washington .....April 28
U. S. Chamber of Commerce Annual Meeting, Washington...April 28-Mar. 1
National Foreign Trade Conference, Los Angeles, ...May 21-23
World Power Conference, Berlin.June 16-25
Railway Supply Mfrs. Assn., Meeting and Exhibit, Atlantic City...June 18-25
American Railway Association, San Francisco .....June 23-26
American Society for Testing Materials, Annual Meeting, Atlantic City .....June 23-27

SALONS

Palace Hotel, San Francisco, Feb. 22-Mar. 1

RACES

Indianapolis .....May 30
Belgium .....July 5-6
Germany (Grand Prix).....July 13
Belgium (European Grand Prix)....July 20
Spain .....July 27
Italy (Grand Prix).....Sept. 7
France (Grand Prix).....Sept. 21

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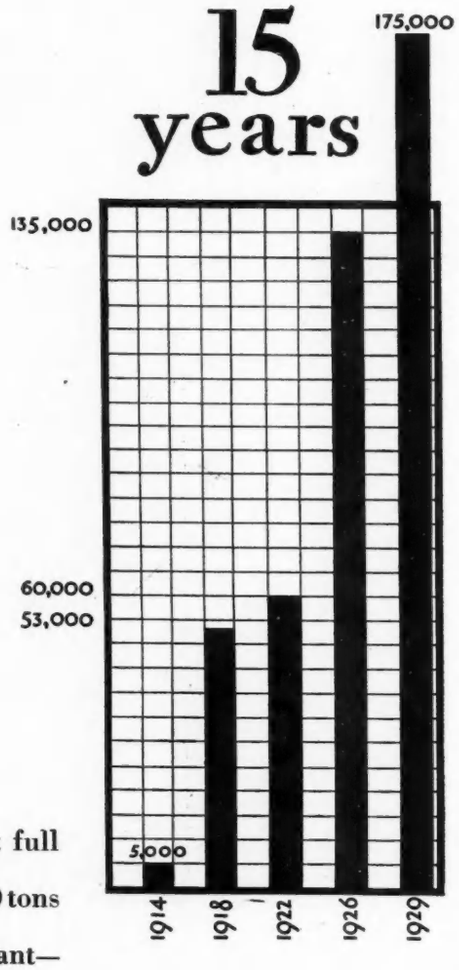
3500% in 15 years



IN 1914, Budd's first full year of operation, 5000 tons of steel came into the plant—and went out in the form of Budd All-Steel Bodies.

Last year 35 times this amount of steel—175,000 tons in all—was needed to build the Budd Bodies demanded by the automotive world. A 3500% increase in 15 years! Think of that!

That's what Budd has done in the past. In 1930, more Budd Bodies will be swung onto chassis than ever before. In Budd's four huge plants, here and abroad, more than a million of these safer, roomier, more beautiful bodies will be built.

E. G. Budd Manufacturing Company, Philadelphia, Detroit—Affiliated with: The Pressed Steel Company of Great Britain, and Ambi-Budd Presswerke of Germany.

BUDD BODIES

BUDD IS THE ONLY BODY BUILDER IN THE WORLD EQUIPPED TO BUILD ANY TYPE OF BODY

AUTOMOTIVE INDUSTRIES
VOLUME 62 *Philadelphia, Saturday, March 8, 1930* NUMBER 10

Higher *Prices* or Lower *Profits*—*Problem* of Next Five Years

With total market expanding slowly, new pressures to transfer merchandising cost burdens from dealers to car makers or public portend increased f. o. b. prices.

By NORMAN G. SHIDLE

THE average f.o.b. price of passenger cars has been declining in general for nearly ten years.

What of the next two to five years?

Immediate examination of economic factors within the automotive industry which will exert upward or downward pressure during this period may give some clue to the correct answer. A correct answer is fraught with importance, not only to passenger car manufacturers, but also to parts, accessory and factory equipment makers whose future plans cannot help but be molded to some extent in accordance with the f.o.b. passenger car price trend.

Evidence that the average f.o.b. price will trend upward in the next few years has been forcing itself to the surface rapidly in the last few months.

Two major economic forces have operated to depress the f.o.b. passenger car price for a number of years:

1. Competition.
2. Necessity for volume, which in a general way varies directly with price.

Both of these factors will be operating during the next five years just as forcefully as they have been in the last five; perhaps their power and weight will be even greater.

But opposing these two downward acting forces, some ten or twelve pressures exerting an upward thrust on the f.o.b. price level have rather recently come to full fruition or entered the automotive economic scheme in an appreciable way for the first time. A generally rising merchandising cost has been a recognized part of the automotive picture for several years back, and there is no indication that the tendency in that direction will be checked in any way; it is more likely to be accelerated. But in addition to this general trend, here is a list of definite relatively recent factors which have entered the automotive scheme of things in a forceful manner, all exerting a definitely upward thrust against current f.o.b. passenger car prices.

1. Junking plans.
2. Need for greater specific, detailed assistance to dealers in merchandising, accounting, used car problems, etc.
3. Pressure on manufacturer to bear share of labor cost on defective parts replaced by dealers within standard warranty period.
4. Pressure on manufacturers to pay freight on defective parts shipments during standard warranty period.
5. Pressure on manufacturer to rebate dealers on models in retail stocks at time a price cut is made.
6. Pressure on manufacturers to make some adjustment to dealer on cars in retail stocks at time new models are announced to public.

7. Pressure on manufacturers to allow larger dealer discounts.
8. Pressure on manufacturers to subsidize retail finance rates.
9. Tendency to go back to inclusion of local advertising costs in f.o.b. price to help reduce current spread between f.o.b. and delivered prices.
10. Possible pressure on manufacturers to ship cars to dealers on other than c.o.d. basis.

Perhaps other items might be added to the list. The foregoing are sufficient, however, to show clearly the multitude of current pressures which, in proportion to the extent of thir incorporation as integral parts of manufacturing policies, definitely tend to force upward the list price of the average automobile.

Some of the items in this list bid fair to have a far more important effect than others; some of them, if adopted as policy, would put a terrific financial burden on the car manufacturer unless he were able to increase his f.o.b. price and keep up his total volume of sales at the same time. Let's check the list over in a little more detail.

Junking plans: The cost of these plans must come from one of three places—the public (the cost being included in increased f.o.b.), the dealer (the cost being taken by a decrease in dealer discount) or from the manufacturer's profit. There is every indication that a majority of the manufacturers installing these plans will choose the increased f.o.b. price method—either directly or indirectly—to try to pay these junking costs. The fairly general adoption of junking plans now under way, then, can be said to be likely to have a very definite upward thrust effect on passenger car prices during the next few years, if not during the next few months.

More Assistance to Dealers

Need for greater assistance to dealers: These costs have been an important part of the generally increasing merchandising cost in the last few years. They will continue to grow almost without a doubt. Their tendency will be definitely toward higher f.o.b. prices.

Pressure on manufacturer to bear part of labor cost and freight charges on defective parts replaced during standard warranty period: With General Motors now paying to dealers one-half the flat rate labor charge on such policy replacements and Hupmobile paying the actual labor charge, some pressure on other manufacturers to follow suit seems almost certain. Freight charges on defective parts also are paid now by one or two manufacturers.

Nobody can tell how widespread these policies may become. But as they grow, they exert an upward pressure on the f.o.b. price.

Pressure on manufacturer to make financial adjustment to dealer on cars in stock at time of a price cut or at time of announcement of new models: Packard Studebaker, Hupmobile and a number of other makers have for years had a definite policy of rebating dealers for cars in stock at time of a price cut. Thus far about half the manufacturers have operated without inclusion of such a policy in their contracts, although many of this latter group have made such adjustments in specific instances. It is likely that the adoption of such a rebate policy will become more widespread as time goes on and as dealer demands for profit-making possibilities continue to increase.

Adjustments on cars in stock at time of new model announcements have never been conceived as a definite part of any factory contract until very recently. Chevrolet is understood to be putting such a policy in operation this year, although details of its working out have not been announced. While any general adoption of such a policy might seem to be another strong influence toward increasing the manufacturer's costs and consequently the list price, the proposition might, conceivably, work out quite differently. The manufacturer who has promised in his contract to make adjustment to dealers on cars in stock at time of new model announcements would be much less likely, it would seem, to make such new model announcements when any considerable number of cars remained in retail stocks to be cleaned up. Thus, the dealer would be better off, while the manufacturer would not find himself burdened with any additional direct financial responsibility from this cause.

Equipment Trends

THE drive for lower production costs seems certain to continue for the next few years. To the machine tool and factory equipment manufacturer this means a period of new opportunity greater than any similar period in the past . . . . Careful study of plant maintenance and material control are due for strong emphasis . . . . Competitive factors will emphasize performance more and price less in factory equipment studies than ever before.

Larger Discounts Always Needed

Pressure on manufacturers for larger dealer discounts: This element, like the poor, is with us always more or less. It is included in the list because, insofar as it is potent, it does exert another upward pressure on f.o.b. prices. Despite dealer unrest, however, there seems to be no reason to believe that this particular factor will be any more bothersome in the future than in the past. We do not believe it will have any marked effect on the f.o.b. price situation, because it is a relative rather than an absolute factor.

Pressure on manufacturers to subsidize retail financing rates: Subsidy of retail financing rates is just another way in which the manufacturer helps to bear some of the cost of retail selling. Insofar as the average dealer thinks he is the gainer from such a practice, pressure for more widespread—and perhaps greater—financing subsidies may come.

The practice has never seemed to be basically sound, any more than the practice of giving dealers an inside trading discount instead of actually cutting retail prices on cars. The dealer is enabled to offer his customer a lower retail financing rate than otherwise would be possible, but the customer pays the subsidy cost in the f. o. b. price and thus basically comes out the same either way. There is no evidence that this will be any important factor in influencing list prices in the coming months or years. Insofar as it has any influence, however, that influence will be for higher rather than lower list prices.

Inclusion of local advertising costs in f.o.b. price instead of in spread between f.o.b. and delivered price: Several manufacturers who have been asking distributors and dealers to pay the cost of local advertising and permitting them to add so much per car to the delivered price to cover that cost are planning an early return to the practice of including those costs in the f. o. b. price.

Wherever this is done, of course, a definite pressure to increase the f.o.b. naturally appears.

Pressure on manufacturers to sell cars to dealers on other than c.o.d. terms: Discussion of this topic has purposely been reserved to the end of the list because of the vast changes that might be brought about in the whole automotive merchandising structure should such pressure ever bear fruit. No such change will ever come about if automobile manufacturers can find any means of preventing it; that goes almost without saying.

The automobile manufacturer has been unique in his ability to do business on so large a scale on this basis. As V. L. Brown, president, Motors' Acceptance Co., of Milwaukee, said at the convention of the National Association of Finance Companies recently:

"Ever since the beginning of the industry, thanks to a very fine trade organization, the automobile manufacturer has been able to exact cash in advance for his product. It is unique in the history of manufacturing that an entire industry over a long period of years has been in position to receive cash in advance for its merchandise. I have never known anything like it in any other industry."

So far there have been only sporadic, minor and relatively unimportant departures from this c. o. d. relationship between automobile manufacturers and their dealers. Smaller car makers have been known to ship on consignment to certain distributors at certain times, but, so far as our knowledge goes, no dealer-manufacturer contract was ever written and signed on any such basis as an expression of factory policy. Even in selling export shipments, American manufacturers have been in the habit of collecting their money before the foreign dealer received the cars—frequently before the cars left this country.

First Rift in Policy

With this background, it has been a bit surprising to note the relatively small amount of interest apparently generated among American manufacturing executives by the first definite, announced rift in this age-long automotive policy by a division of the organization of so important a manufacturer as Henry Ford.

About two months ago, Sir Percival Perry, head of the European Ford Motor Co., announced that Ford dealers in England from now on would be given 90 days credit on the minimum range of models each one is required to hold under the terms of his contract, apart from the vehicles he will employ for demonstration purposes.

As each car is sold it will be replaced immediately by another of the same model, though presumably the one sold will have to be paid for before the one to replace it is supplied on the new basis.

The statement made by Sir Percival Perry in connection with the announcement seems fraught with significance, coming as it does from a man holding so important an executive post in the Ford organization. "Discussing this change in policy," M. W. Bourdon, British correspondent of *Automotive Industries*, writes, "Sir Percival Perry said that it was one of the anomalies or inconsistencies of the motor industry that it took advantage of the credit system on its purchasing side and insisted on the distributing party paying cash for its stock models. This practice, he said, debars the public from seeing a full range of models at many showrooms where, in ordinary course of events, it would go to make its purchases. In any case, credit is so important a part of the machinery of trade and industry that it ought to be made to work smoothly in all directions. By putting it on a definite and recognized basis, so far as the motor trade is concerned, it should make for increased sales."

Whether any such development will ever appear as a part of any car manufacturer's policy in the United States is hard to tell. There seems to be no immediate likelihood of it. To deny the eventual possibility of such a development, however, is to hide one's head in the sand. The whole subject is far too broad to permit even limited treatment in a few sentences, involving as it does trends in retail financing, bankers' attitude toward the automobile dealer, factory financial resources, and a host of intermediate marketing intricacies. It is mentioned here solely because, should it ever develop, it probably would be more potent than any of the other items in the foregoing list in pressing upward the f. o. b. price.

The f.o.b. passenger car price, then, appears to rest for the coming few years between two strong downward forces—competition and the necessity for volume—and a host of upward thrusting forces which bid fair, for the first time in ten years, to exert enough combined pressure to force some upward movement, the magnitude of which nobody can possibly estimate with any accuracy at the present time.

Can f.o.b. prices increase without our having a decrease in actual number of sales?

The answer to that question, we believe, is very definitely, "Yes."

The automobile business still is in a basically expanding market. Although the rate of growth in the domestic market now is very little ahead of the rate of growth of population, its foreign markets fundamentally should continue to expand for a decade or more. Thus even with increased f.o.b. prices, it seems certain that a continued actual expansion cannot be denied the industry in the next five-year period, and likely that its expansion on this basis will be more profitable for all concerned than if it were at a more rapid pace numerically with lower prices and lower profits all along the line.

Competitive considerations, of course, will cause practically every manufacturer to resist to the fullest extent of his ability many of the factors which may give an upward thrust to the f.o.b. list. Some of them he may oppose directly; others he may accede to readily—as in the case of junking plans—but try offset their effects by applying pressure for economies elsewhere.

These economies which he may seek to keep the f.o.b. price as low as possible, even if some increases do turn out to be necessary, may perhaps be found in several sources.

(Continued on page 402)

Potential Profits

***ALTHOUGH** the rate of growth in the domestic market is very little ahead of the rate of population increase, foreign markets should continue to expand . . . Even with increased f.o.b. prices, it seems certain that a continued actual expansion cannot be denied the automobile industry in the next five year period. And likely this expansion . . . will be more profitable on this basis than if it were at a more rapid pace with lower prices.*

Plant Facilities for the Manufac Realigned in *Accordance With*

In the production of the new six-cyl minimized by arranging operations chines and by linking sub-as

By JOSEPH

ADAPTATION of certain elements of mass production to qualify production requirements is well exemplified in the realignment of plant facilities for manufacturing the new "Blue Streak" six-cylinder Autocar engine which has been just introduced by the Autocar Co., Ardmore, Pa. (Detailed description on page 402 of this issue.) In all probability there is no more difficult production problem than that of moderate production of high quality, for it is necessary to consider the delicate economic balance of production rate on one hand, and of machines, progression of operations and materials handling on the other. At the Autocar plant the entire engine building division was rebuilt completely; wherever necessary, new equipment was installed, but in every case the elements of output and production rate were balanced against the investment. As will become evident later, manual effort has been minimized if not altogether eliminated, this being accomplished by arranging operations progressively; by regrouping of machines, and finally by linking all operations with a roller conveyor.

Wherever handling or lifting is necessary, as for example in loading rough cylinder blocks and crankcases at the initial milling operations, hand hoists or electric hoists are employed. Hoists are also provided in other parts of the plant where units are lifted from the conveyor to the machine or to the assembly line. Here again the economics of the materials handling problem were carefully considered and the equipment designed to adequately fit their problem within the limits of the capital investment. As would be expected, the machine equipment is largely of universal character, well adapted to changes in design and capable of moderate output. Accordingly, the engine plant is equipped with multiple-spindle drilling machines, radial drills, standard milling machines and a few single-purpose machines.

One is particularly impressed by the care taken to control and check the quality of the work. Each operator is supplied with a set of inspection gages, with which he checks the finished operation. By far the most interesting development in this connection is the installation of master inspection fixtures built right into the roller conveyor and designed to check the key elements of each major operation. One of these fixtures is shown diagrammatically in Fig. 1. This arrangement assures 100 per cent inspection because the finished piece must pass through the fixture while proceeding to the next operation. Design of jigs and fixtures as well as inspection gages and small tools follows through the general principle of balancing outlay against specific requirements. Accordingly, we find drill jigs of simple design. In fact, where possible, they are mostly a refined form of bushing plate. On the other hand, the design of the tooling incorporates every element necessary to insure precision within required limits, in consequence of which the tooling is massive, providing the maximum of rigidity. This is especially true of important operations such as boring the crankshaft

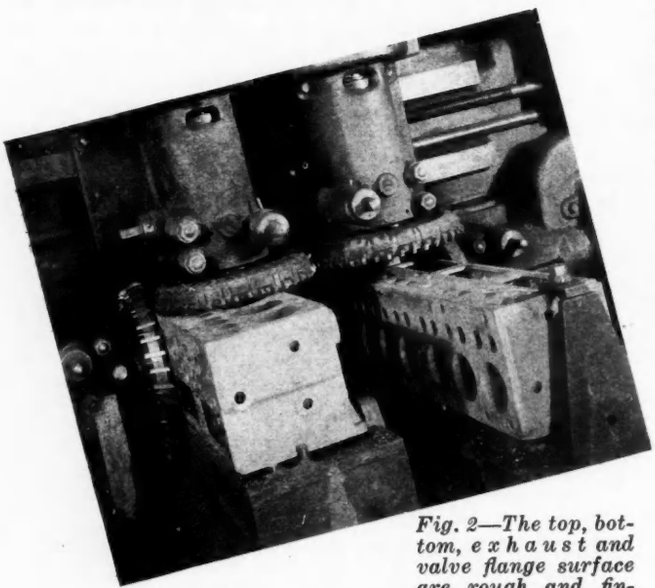


Fig. 2—The top, bottom, exhaust and valve flange surface are rough and finished milled on an Ingersoll multiple head planer type miller

As cylinder blocks are chrome nickel steel castings, cutters for the rough milling are equipped with Stellite blades and those for finishing are equipped with high speed steel. Master gages are employed in the setting of the cutters, whereby extreme accuracy is maintained in the machining of the above surfaces

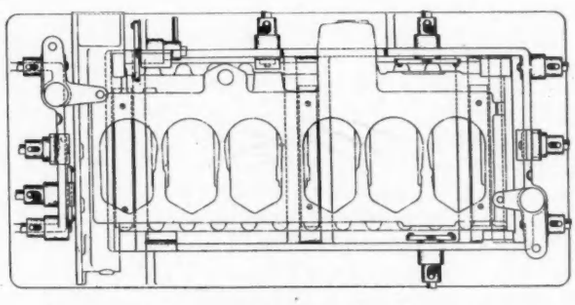


Fig. 1—At the Autocar plant, master inspection fixtures, such as the above, are designed to check the key elements of each major operation

ture of the Autocar *"Blue Streak"* *Output Rate* and Investment

inder engine, manual effort has been progressively, by regrouping masemblies with a roller conveyor.

GESCHELIN

bearings, and even more so in the finish-reaming of camshaft and crankshaft bearing. Rust-proofing of the crankcase and cylinder block is not much of a problem here, for they have solved it by preventing rust before the castings get to the first operation. Just as soon as the castings enter the machine shop, they pass through a spray booth where they are coated with engenamel.

Following the best current practice, in the automotive field, the manufacturing department is laid out with the final assembly line as the focal point. Manufacturing departments are arranged on each side of the assembly line, so that the finished parts are fed in proper sequence to the engine assembly. The foundation of the entire engine is built about the construction and processing of the massive cylinder block and crankcase castings. We can, therefore, begin with the cylinder block and trace through some of the key operations performed on it. The cylinder block is a casting of chrome nickel steel, and since machineability and quality are related to surface hardness, the first inspection is concerned with the Brinell hardness; then the casting is sprayed with engenamel and proceeds through the initial face milling operations, one of which is shown in Fig. 2.

Fig. 5—All multiple drilling operations at the Autocar plant follow a progressive gang drilling practice, advancing from machine on roller conveyors

Fig. 4—The cylinder blocks feed directly from the roller conveyor to locating stops on table of the above machine

The first twelve spindles core drill and semi-ream valve tapped guide holes, the second twelve spindles drill the valve guide holes and exhaust and intake port holes. The tools are of a combination design and supported by bearing plates carried on head of machine, which insures equal spacing and alignment

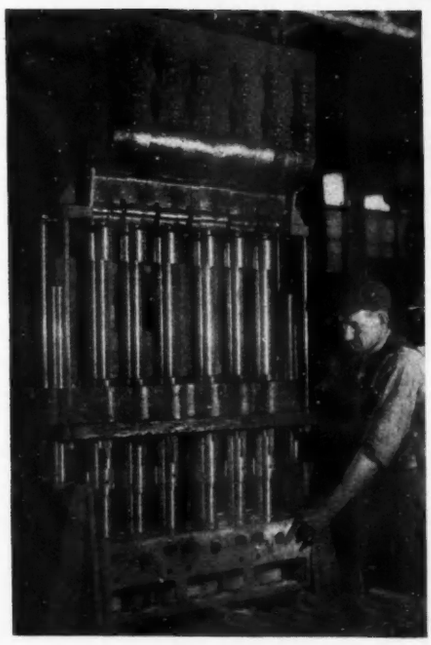


Fig. 3—Autocar six-cylinders are finished bored with Stellite high speed cutters inserted in boring bars that are piloted top and bottom

An interesting device employed in getting a good alignment of rough casting in the fixtures controlling the first operations consists of three bosses, accurately cast on each side of the block, thus providing a three-point location in the fixture. This three-point location provides a more flexible means of control without subjecting the casting to undue strain. The block next passes through several routine operations until it reaches the important operation of rough boring cylinders on the six-spindle machine shown in Fig. 3, where the 4½-in. cylinder is rough bored to 4.435-4.440 in. Fig. 4 shows the succeeding operation on a 24-spindle Baush drilling machine.

Next, the valve tappet guide holes and valve guide holes are drilled successively on two 24-spindle Moline Hole-Hogs. They then pass to another bank of Moline

machines where the valve guide holes are reamed and the valve tappet guide holes bored to size. A view of one of these operations is shown in Fig. 4. A very neat

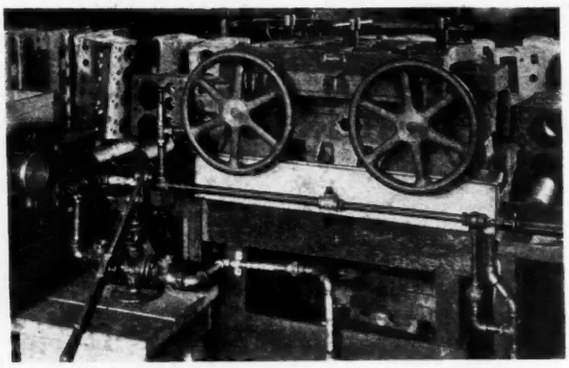


Fig. 6—The cylinder block water testing fixture is directly in line with the roller conveyor; as the blocks advance to this operation they pass into the fixtures to a stop which properly locates the block in the fixture

Steel plates with inserted rubber pads which are part of the fixture are quickly clamped to all openings of the water circulating area by large wheels and clamp screws. The block is subjected to a pressure five times greater than it is subjected to in actual use

arrangement employed here is an air hoist block fixture built in the conveyor line, separating the rough and finish operations described here. As the cylinder block passes over the fixture, the drill jig used on the first operation is loosened, drops on the hoist plate and following the movement of an air valve is lowered below the level of the conveyor, permitting the block to be rolled on to the next operation.

The cylinder block then progresses through a number of other multiple-spindle operations, one of which (Fig. 5), the drilling of 36 holes in the top, presents an interesting problem by virtue of the fact that the 36 spindles could not be clustered together sufficiently close to drill all the holes simultaneously. This is accomplished by drilling part of the holes and then shifting the block and fixture forward so as to engage the remaining drills.

After the drilling operations the block is finish bored, this being 4.495-4.497 in. for the 4½-in. cylinder. The valve guides are then pressed in, and immediately following this operation the cylinder block is constrained to pass the water test fixture which is built into the conveyor as shown in detail in Fig. 6.

Water jackets are tested at a hydrostatic gage pressure of 80 lb. per sq. in. The final major operation is that of finish honing cylinder bores on a single-spindle Moline honing machine (Fig. 7), equipped with a Jeschke micromatic hone. Each honed cylinder bore is held to 0.0005 in. for out-of-roundness and 0.0005 in. tolerance for tapering bore. This is followed by a final inspection which includes gaging of each cylinder by means of a Federal cylinder indicating gage. For their purpose the single hone keeps the production line fed smoothly.

In a similar manner the crankcase is sprayed for rust-proofing and passes through the million machines department on a line of machines paralleling the cylinder block line. The first operation is that of milling the top face and bearing seats by means of a built-up step milling cutter. This establishes the locating points for the second milling operation, where the bottom and sides of the crankcase are finished on the Ingersoll milling machine shown in Fig. 8. In the third operation, two dowel holes are drilled for locating the crankcase on succeeding operations. The crankcase then proceeds through a number of multiple-spindle operations where all the holes are drilled and tapped as required.

An interesting step is the drilling of the ⅝-in. oil hole through the entire length of the crankcase, for, as has been noted from the specifications, no auxiliary oil leads are employed, the bearing being fed by diagonal holes through each bearing communicating with this one. Also of interest is a hand operation consisting substantially of tapping the bearing stud holes by means of a ground hand tap to insure accurate fitting of the studs.

After the bearing caps are assembled, the crankcase is set up on the boring fixture on the National double-end boring machine (Fig. 9), where the camshaft bearings, crankshaft bearings and auxiliary bearings are bored in the one setting. The left-hand head bores and semi-finish reams five camshaft bearing holes and seven crankshaft bearing

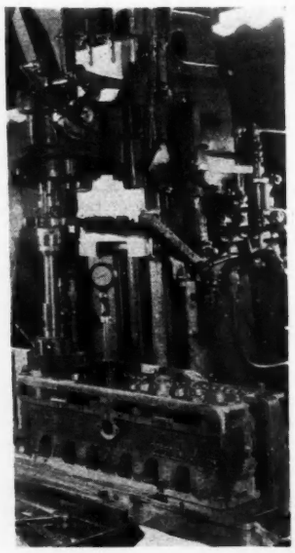


Fig. 7—Cylinders are placed on locating dowel pins in a fixture of sliding plate index design which insures centralization of bores for honing

A Jeschke micromatic hone using three No. 150 grade stones and three No. 80 grade stones is used

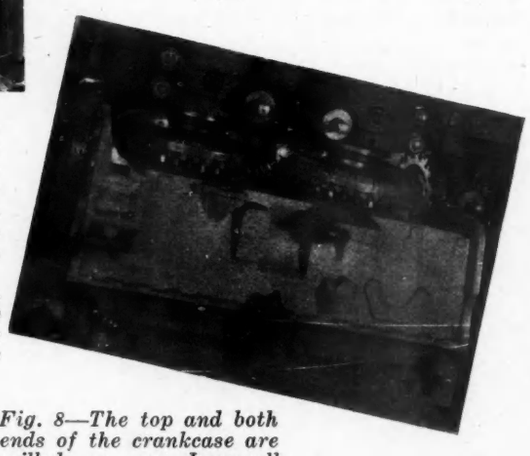


Fig. 8—The top and both ends of the crankcase are milled on an Ingersoll planer type miller

Due to the fact that the manner in which the case is located in the fixture and the setting of cutters, extreme accuracy is maintained in relation and alignment of milled surfaces and main bearings

Fig. 9—Fixture for boring camshaft and crankshaft bearings. Note lever at left which raises and lowers the crankcase

holes, while the right-hand head handles the boring bars for the accessory shaft, generator shaft and the idler gear. The two outer boring bars at the right-hand head are supported at their outer end for rigidity, while the bar for the idler gearshift hole, which cannot be supported at the end, is, nevertheless, aligned rigidly by means of the long overhanging bearing. The outstanding feature of this operation is the rigidity of the machine, the fixture and the boring bars. Another noteworthy feature is that the fly cutters are adjusted and rigidly fixed, this being made possible by providing a vertical adjustment in the fixture. When the crankcase is first set up in place a movement of the lever shown at the right of the fixture lifts the crankcase and permits the boring bars to be pushed through with the lower part of the bar "riding" on the bearing. In other words, the distance from the bottom of the boring bar to the tip of the fly cutter is just a little smaller than the diameter of the hole and passes through readily. When the boring bars are in place with cutters clearing the bearings, the lever is depressed and the fixture is locked in position, automatically, aligning the boring bars with the centers of the bearings. The cutters then cut their own clearance.

At Autocar this boring operation is considered one of the most important features of the entire job, and every precaution has been taken to turn out the work consistently within established standards. As an adjunct to this thought, the fly cutters are staggered on the boring bar so that only certain ones in one line are cutting simultaneously, the idea behind this being to reduce strains on the crankcase structure and to eliminate the possibility of misalignment when the work has been removed from the fixture.

The cylinder block and crankcase operations are so arranged that both units meet at a central point, where the block and crankcase are permanently bolted together with a gasket between. This sub-assembly is then placed on the lathe, shown in Fig. 10, where the camshaft and crankshaft bearings are finish-reamed by means of the massive boring bars to a tolerance of 0.0005 in. This is the final operation and is designed to assure perfect alignment between the cylinder block and crankcase. After reaming the crankcase, the camshaft bearings are pressed in and hand-reamed to size. The complete sub-assembly is now ready for the main assembly line.

Connecting rods are drop-forged and sized at the large and small end on the coin press. After passing through intermediate operations of drilling, broaching the small end and milling operations on the big end, the inside of the large end is elaborately grooved on the Wicaco grooving machine, shown in Fig. 11, to provide an adequate seat for babbitt adhesion.

The rod is then washed, tinned

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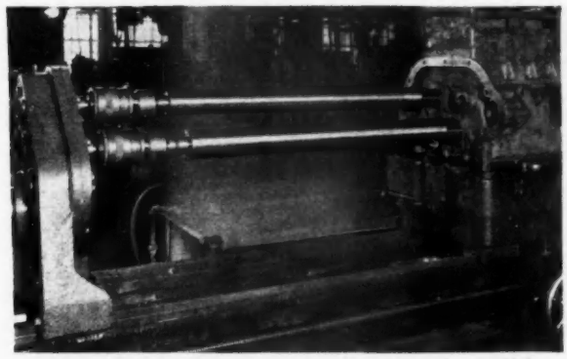


Fig. 10 — Reaming of crank and camshaft bearings

After the final machining operations have been performed on the crankcase and cylinder block they both meet on the conveyor line and are assembled together

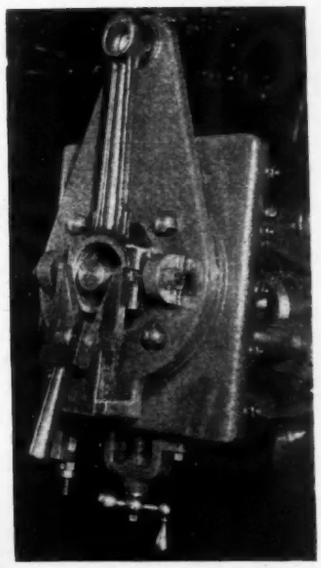


Fig. 11 — The connecting rod forging after being bored is placed in Wicaco grooving machine and a crossed and recrossed system of groves are cut in the crankshaft end of the connecting rod. This insures perfect doweling and aids in the adhesion of the babbitt

Fig. 12—Upon completion of the various assemblies of the crankcase and cylinder on the roller conveyor line, it is raised by an air hoist to the final assembly conveyor

Special rollers are placed in the rear motor support holes and a special yoke or carrier on rollers supports the front end of the motor. The motor then travels on this conveyor in an upright or proper position

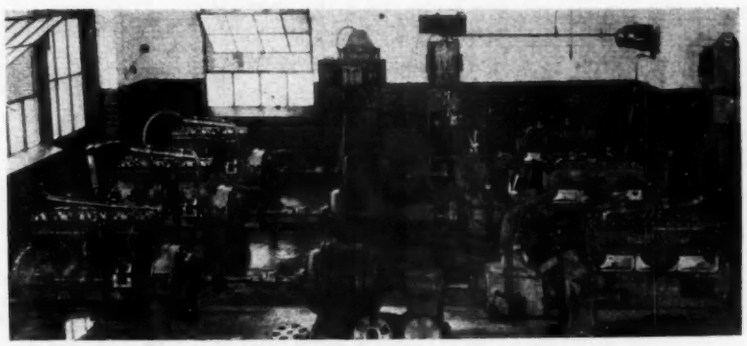
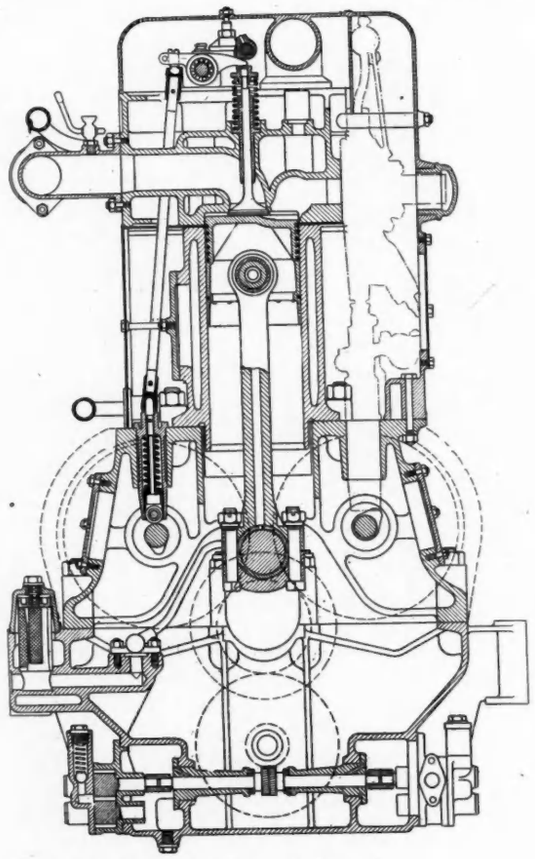


Fig. 13 — The Autocar powerplant before being placed in service is given a rigid inspection and is limbered up before going into the chassis assembly

Fuel Injection With By-Pass Valve Developed by *Linke-Hofmann-*

THE Linke-Hofmann-Busch Works of Breslau, Germany, have introduced a line of five four-cycle Diesel engines for automotive and marine work as well as for stationary purposes. The smallest of these, a four-cylinder, developing 50-60 hp. at 1200-1500

Compression chamber is of unusually compact design. The combustion space is formed by a small lateral pocket cast in the cylinder head.



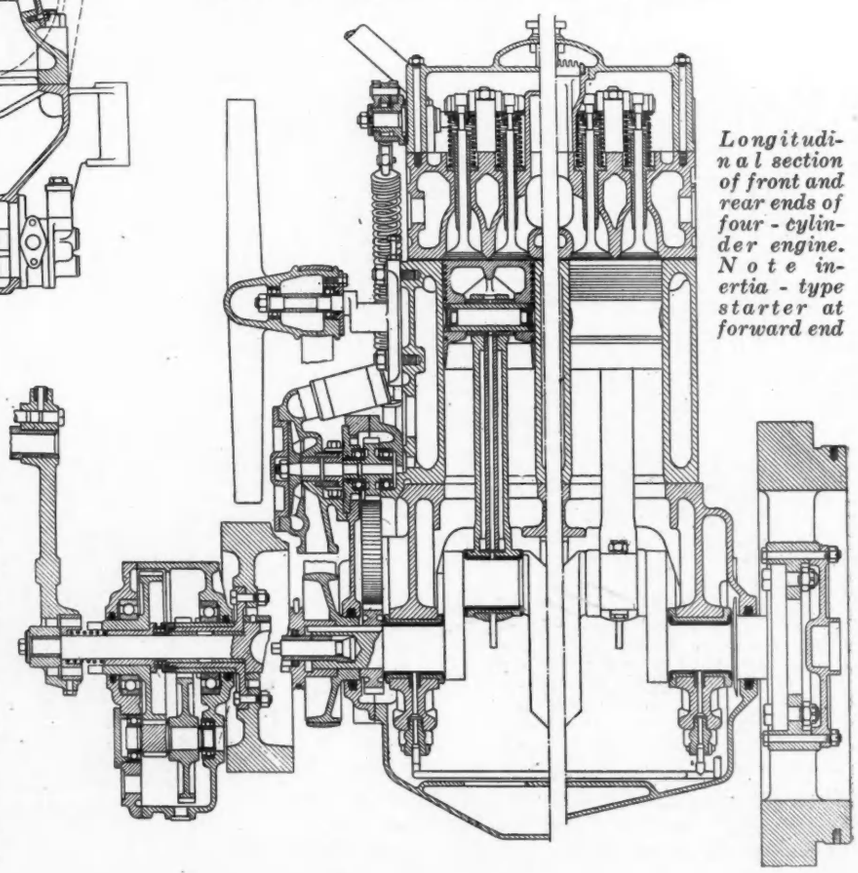
Cross-section through cylinder of Linke-Hofmann oil engine, fuel pump and injection mechanism being indicated in dotted lines

r.p.m., and the next in size, a six-cylinder having an output of 90 hp. at 1300 r.p.m., are intended specially for trucks, buses and tractors. Other sizes include a four developing 100 hp. at 1200 r.p.m., a six of 150 hp. at 1200 r.p.m. and a six of 300 hp. at 1000 r.p.m.

The small four-cylinder has a bore of 4.52 and a stroke of 6.49 in. and operates at a compression of 455 lb. per sq. in. The cylinders are of cast iron and in a single block. The separate crankcase also is of cast iron but can be made of aluminum if desired. The cylinder heads, which contain the valves, are in two castings. Valves are operated by side rods from a camshaft located in the crankcase in the right-hand side. There is a second camshaft for operating the fuel pumps (of which one is provided for each cylinder) in the left half of the crankcase.

It is claimed for the engine that it operates smoothly and without smoky exhaust throughout the speed range of 250 to 1200 r.p.m. The normal output at 1200 r.p.m. is 50 hp. but the engine will carry an overload of 10 per cent continuously and 20 per cent temporarily. It weighs 926 lb. without and 1102 lb. with flywheel.

Crankshaft bearings are of the steel-back, babbitt-lined type and piston pin bearings of bronze, the pins being full-floating. The crankshaft is made of chrome-nickel steel, while the round-section connecting rods are of aluminum alloy. Pistons are of cast iron. Lubrication is by the pressure system, even the piston-pin bearings being supplied with oil under pressure.



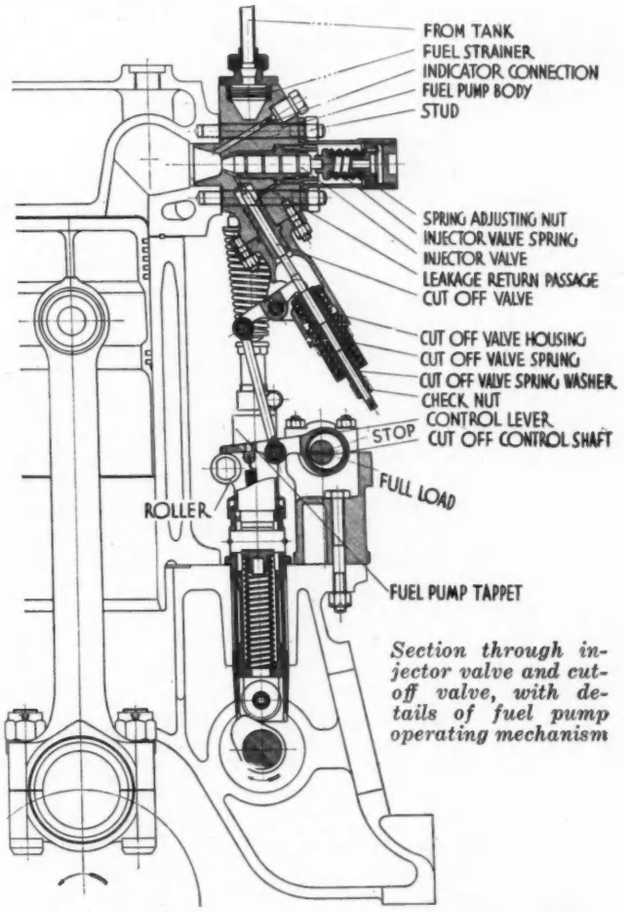
Longitudinal section of front and rear ends of four-cylinder engine. Note inertia-type starter at forward end

Control for *Diesel Engines*
Busch

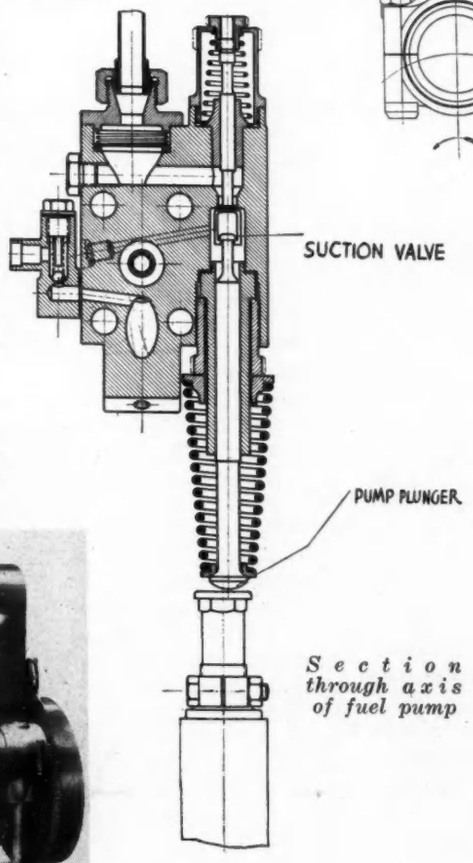
By EDWIN P. A. HEINZE

The combustion space is formed by a small lateral pocket cast in the cylinder head, into which the spray nozzle discharges horizontally.

The injection nozzle and pump for each cylinder form a separate unit which is bolted to the side of the combustion chamber. Two sections through the pump-injector unit are shown herewith. Referring first to the vertical section through the axis of the pump plunger, the fuel arrives from the tank through a tube connecting at the top and passes through a strainer below the connection. It then passes through a horizontal drill hole to the inlet valve chamber on the right. The inlet valve opens downwardly and admits fuel to the pump cylinder, whose plunger is actuated from the camshaft in the crankcase by a roller-type tappet. The delivery stroke of the pump plunger is performed positively under the direct thrust of the cam and the plunger returns under the action of its spring. The clearance between the plunger and the valve tappet is adjusted so that a thin sheet of paper would be lightly held between plunger and tappet when the crankshaft is turned to an angular position corresponding to the point of the cycle at which it is desired to have ignition occur as indicated by a mark on the flywheel.

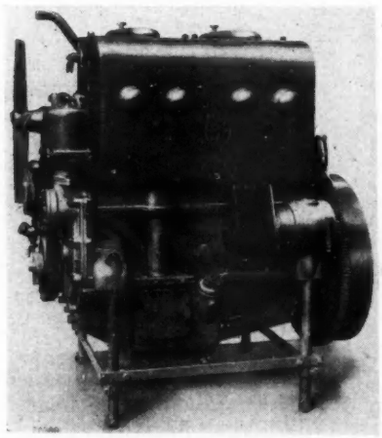


Section through injector valve and cut-off valve, with details of fuel pump operating mechanism



Section through axis of fuel pump

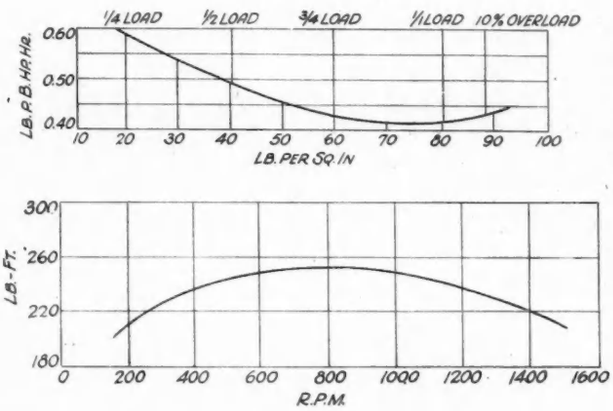
Linke-Hofmann truck engine. The housing over the injector units gives a very clean-cut exterior



From the pump chamber there is communication with the space surrounding the conical end of the injection valve, which latter is clearly shown in the other sectional view. The communication passage is indicated in dotted lines in the first view. When the pump plunger puts the fuel under pressure the injection valve is raised from its seat against the pressure of its spring—which latter can be varied by means of a threaded ring—and the fuel is injected into the combustion chamber. Thus the beginning of the injection period is determined by the motion of the pump plunger.

The end of the injection stroke is determined by means of a cut-off valve, a needle valve inclined at 30 deg. to the vertical. This cut-off valve is operated from the tappet for the pump plunger through a roller on same, a single-armed lever resting with its free end on this roller, a link and a double-armed lever. After a certain portion of the delivery stroke of the pump plunger has been completed, the cut-off valve is

opened positively, which relieves the pressure on the fuel and causes the injection valve to close instantly. The fuel moved by the pump plunger during the rest of its stroke passes through the cut-off valve and through a ball check valve (shown in the section through the pump axis) back to the supply tank. The point of cut-off can be varied by means of an eccentric mounted on a control shaft. The eccentrics for all of the pumps are mounted on the same shaft, and a lever at the rear end of the latter is connected to a foot lever corresponding to the accelerator pedal on the ordinary car. The two extreme positions of the control shaft, corresponding to "shut-off" and to "full load," are indicated in the drawing.



Performance characteristics of Linke-Hofmann Diesel engines

The pump and injector unit offers several manifest advantages. First of all it does away with high-pressure fuel pipes, with their tendency to "breathe" under pump impulses, and to become leaky; secondly, the column of fuel to be set in motion at every pump stroke is a very short one. On account of the absence of pipes, prolonged injection or after dripping is said to be impossible.

It will be seen that all of the pump-injector units and their operating mechanisms are neatly housed, producing a very clean-cut exterior.

The cooling system follows general automotive practice. An electric generator and starter of Robert Bosch make are fitted. For starting a valve lifter is provided. The engine also may be cranked by hand, for which purpose a crank with a high-geared flywheel (inertia starter) is provided. The larger engines have compressed-air starters.

The six-cylinder engine of 80-90 hp. is very similar to the one here described, while the larger 150 hp. six-cylinder is of somewhat different design. Its bore is 5.70 and its stroke 8.26 in. The crankshaft has seven bearings, and the cylinders are cast in pairs.

Plant Facilities at Autocar Realigned

(Continued from page 397)

and the babbitt is cast-in centrifugally. The babbitting operation is watched closely, both the tin and babbitt tanks being thermostatically controlled and the temperatures checked by recording pyrometers. The bearing is then split and the rods gun-drilled two at a time on a horizontal P. & W. rifle-boring machine. A bronze bushing is pressed into the small end and reamed. Then both small end and big end are bored at the same setting, with two separate spindles to maintain absolute center distances and diameters.

Pistons and connecting rods are kept in individual racks of six, selected for weight. They are assembled in matched sets of six, and the final assemblies are sent directly to the main assembly line.

Fig. 12 shows the general arrangement of the main assembly line, starting with the block and crankcase sub-assembly in the background. The following routing gives a perspective of the general operations along the assembly line with stations corresponding approximately to the location of major sub-assemblies:

Station No. 1—Place cylinder block and crankcase assembly on motor assembly line. Assemble crankshaft bearings and crankshaft to motor.

Station No. 2—Assemble flywheel assembly, clutch housing and clutch assembly to motor. Assemble camshaft and gear assembly to motor. Assemble generator and starter to motor.

Station No. 3—Assemble piston and connecting rod assemblies to motor. Assemble valve plunger guides and valve plungers to motor and adjust valves.

Station No. 4—Assemble oil pump assembly and oil pans to motor. Assemble engine front cover and timing gears to motor.

Station No. 5—Assemble accessory shaft, water pump, magneto bracket and magneto to motor. Assemble water cover plate, oil gage, oil filtrator, fan pulley and front cover baffle plate to motor. Place cylinder head studs and assemble cylinder head to motor. Place manifold studs and assemble inlet and exhaust manifolds to motor. Assemble valve plates and oil pump gear cover to motor.

Station No. 6—Assemble distributor, wiring and conduit guide to motor and time motor. Assemble breather body, water pump elbow, manifold shields, petcocks, etc., to motor.

Station No. 7—Assemble trunnion block bearing, transmission and controls assembly to motor. Adjust clutch and final check up.

The new final engine test department is shown in Fig. 13. Engines enter directly from the assembly line, are placed on the stands and are run in for a total of 8 hr. It will be noted from the illustration that engines are bolted together, so that one engine runs the other. Between them is a booster generator which permits greater loading during the latter part of the test. When an engine has been run in, it is ready to break in a green engine, so that each engine actually runs 4 hr. to run in and then runs 4 hr. additional under its own power breaking in a green engine. At the completion of the test the engine is hoisted onto a stand, where the oil pan is removed, all the oil drained off and the engine inspected. The oil pan is then reassembled, the engine filled with oil and is ready for the chassis assembly line.

Silver Solder's Low Melting Point Is Its Chief *Attribute*

Process is often preferred to bronze welding in the manufacture of automobile parts because it gives a joint lighter in color and its resistance to corrosion is high.

SILVER soldering is a process which has long been used in the manufacture of silver plate and of jewelry, but its introduction into the automotive accessories industry has been of recent date. The use of silver solder in connection with articles of other metals than silver has grown recently chiefly because the composition of the solder itself has been improved, which makes it readily applicable by means of the oxy-acetylene torch. In the automotive accessories industry silver soldering competes with the so-called bronze welding, and it is often preferred to the latter, because it gives a joint which is lighter in color and because it has a lower melting point than bronze.

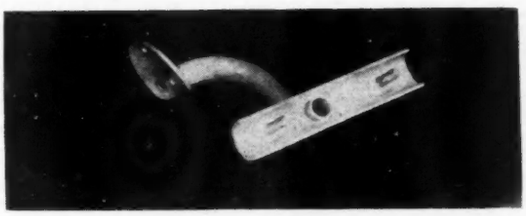


Fig. 1—The cowl lamp bracket fabricated by silver soldering

The following details regarding the present practice of silver soldering in the industries are taken from an article in *Oxy-Acetylene Tips* for October, 1929. When a lap-joint is to be made between two brass parts it is often advisable to use silver solder, because the temperature required for melting bronze solder would be likely to melt the pieces to be joined, while the silver solder readily flows into the joint at a temperature which does not endanger the brass parts. In a lap-joint the area soldered is made large enough so that a stress sufficient to break the base metal would cause a rupture outside the joint. Any difference in tensile strength and ductility between silver solder and a brazing alloy would therefore be of no importance. In some cases a fillet type of joint is made, and sufficient reinforcement is then used to insure a sound joint. As a rule, however, the filler-type of joint is required only when the color of the bronze joint is objectionable. The low melting point of silver solder is its greatest advantage in most cases.

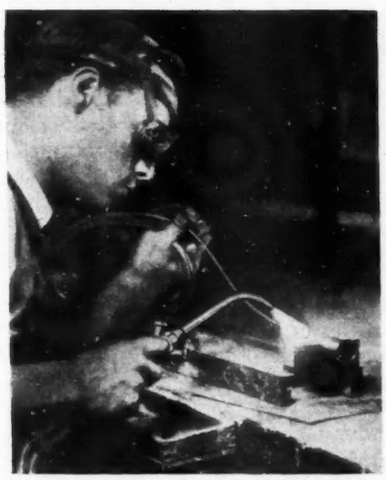


Fig. 2—Silver soldering conduit for ignition cables

The process of applying silver solder by means of the oxy-acetylene torch is simple and can be easily learned by anyone familiar with the welding flame. As in welding practice, the parts to be soldered are first thoroughly cleaned, either mechanically or chemically. The edges of the joint should be smooth and fit tightly, as only a thin film of the solder is needed to give a sound joint. It is wasteful to use silver solder as a filler. Good fluxing is as important as in bronze welding. For general soldering a saturated solution of borax may be used, which is most effectively applied with a brush, both the parts to be joined and the soldering wire itself being "painted."

The flame produced by a small oxy-acetylene sheet-metal welding blow-pipe or a lead-burning blow-pipe is most suitable for this work. When very small parts are being soldered, a torch using acetylene and air will give enough heat for the work, but in production work the oxy-acetylene flame, properly handled, will do the work most speedily. After fluxing, the joint and surrounding metal should be gently preheated, care being taken that the base metal does not reach the melting point. When sufficient preheat has been applied the flame should be moved away and the silver solder brought to the point where it will melt and flow quickly if the parts have been properly fluxed and preheated.

Silver solder will stand up under conditions of constant vibration, a fact which is affirmed by its use on delicate vibrating parts of radio loud speakers and by many other applications where severe vibration has to be withstood. Joints silver-soldered by the oxy-acetylene process also are said to show great resistance to shock, having a tensile strength of 40,000 to 60,000 lb. per sq. in. Under the oxy-acetylene flame

Fig. 3—Silver soldering studs on lamp brackets

silver solder flows so evenly that it pentrates quickly and deeply into all parts of the joint, leaving no pin holes.

Another advantage of silver solder is its resistance to corrosion. Chemical agitator kettles and other items of chemical equipment are generally fabricated of monel-metal or nickel, which are silver-soldered with the oxy-acetylene torch. Another good feature of silver solder is its good electrical conductivity. All joints in electrical circuits must be soldered so they will maintain uniform conductivity, and silver solder has proved excellent for making such joints.

An interesting production job in which oxy-acetylene silver soldering is being used is the assembly of brass brackets for automobile cowl lamps. These brackets have two stud bolts each which are silver-soldered to the bracket to provide a means of attaching the light. Fig. 3 shows one of the men at work with a sheet metal welding blowpipe soldering the studs onto the bracket. The same procedure applies to silver soldering brass as to copper and other metals. The low melting point of the silver solder and its neat appearance are the features which make its use so satisfactory in this case. Fig. 1 shows one of the brackets after the silver soldering has been completed. Note the neat appearance of the solder. Some of these brackets are chromium-plated subsequently. Fig. 2 shows the oxy-acetylene blowpipe being used in silver soldering an electric wire conduit for an automobile ignition system in one of the big production plants.

Autocar Announces Six-Cylinder Engine

A SIX-CYLINDER new truck engine, known as the "Blue Streak," has been developed by the Autocar Co. of Ardmore, Pa. It is made in two cylinder bores, 4¼ and 4½ in. The stroke of both models is 4¾ in., making the displacement of the smaller model 404 and of the larger 453 cu. in. The smaller model develops 90 and the larger 101 hp. at 2000 r.p.m. With battery ignition the engines can be idled at 200, and with magneto ignition at 250 r.p.m.

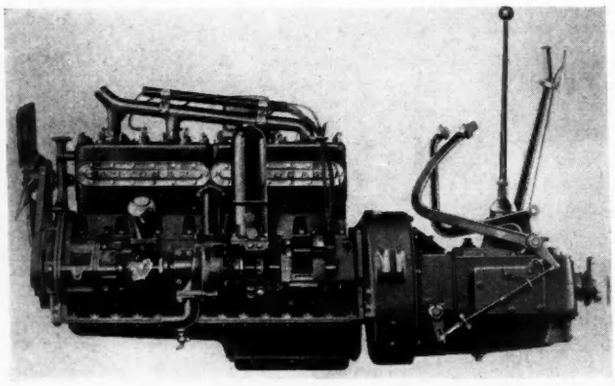
The Blue Streak engine is designed to stand up under heavy-duty service at high speeds. To assure smoothness of operation and freedom from vibration, the crankcase is of rigid design. Its upper section is carried 3½ in. below the crankshaft axis. The stiffness is further increased by heavy ribs extending across the bottom of the case and connecting the bearings with the side walls. In order to stiffen the cylinder block, the waterjacket is extended all the way down to the base flange, lending additional support to the latter.

Cylinder blocks are cast of nickel-chromium iron. The cylinder heads are in two castings. A compression ratio of 5.1 to 1 is employed, the actual compression pressure being 95-100 lb. p. sq. in. gage.

The crankshaft is a chrome-nickel steel forging with seven main bearings. These bearings are 3 in. in diameter; the front bearing is 2 in. long, the center and rear bearings are 3 in. each, and the intermediate bearings 1⅝ in. each. Connecting rods are of the usual type, 10¼ in. long between centers, with 2½ by 1 23/32-in. bearings at the big end and a 1⅛-in. bearing at the small end, the lengths of this latter bearing being slightly different in the two engines. Pistons are of cast iron, 5¾ in. long, and fitted with four rings above the piston pin, of which the lowest is an oil-control ring.

Inlet valves are made of chrome-vanadium steel and exhaust valves of silchrome steel. Both sets have a clear diameter of 1¾ in. and a lift of ⅜ in.

The standard ignition system comprises a Robert Bosch ZR-6 magneto with impulse starter, but a battery ignition system with semi-automatic spark control is offered as an option. A Handy suction-type governor is fitted and keeps the speed of the engine down to 1800 r.p.m. Lubrication is by the pressure system, and an H.W. filtrator is fitted, with an emergency oil by-pass line around the filter.



Autocar six-cylinder truck powerplant

Higher Prices or Lower Profits

(Continued from page 393)

Continuance and further impetus to the drive for lower production costs without reduced quality, for example, seems certain in the next five years. To the machine tool and factory equipment manufacturer this means a period of new opportunity and new possibilities; greater than any similar period in the past. Scrapping of obsolete equipment, installation of devices embodying the latest technical developments, realignment of old methods, careful study of plant maintenance and material control problems all are due for strong emphasis. Competition, we believe, will bring a necessity for sure-fire quality, reduction of waste to a minimum and accuracy in manufacturing that will mean more emphasis on performance and less on price in factory equipment studies than ever before.

Fewer model changes may be seen than in recent years, with a saving of the vast engineering and production-change costs involved because of the speed frequently demanded in the changes heretofore. Reduction in number of model changes, too, might alleviate the pressure from dealers for some of the other policy changes which, if adopted, would tend to force the list price upward.

Technical developments in the parts and materials fields also may help the car maker to hold down his costs. Here again, the pressure will be for better functioning units and materials of different types, rather than price pressure for merely lower prices on existing units. Few car manufacturers from here on, we believe, will care to risk their basic stability by cheapening their products in quality or by endangering the stability of their supply sources by making impossible demands. Their stake in the future of this industry today is too large to risk playing with such fundamentals of industrial stability of fair prices for honest quality.

Just Among Ourselves

Service Shop Owners Are the New Car Merchants

IN several small towns, we hear, competitive dealers have banded together to provide a profit-making service set-up, handling general as well as quick service on all makes of cars. This is just another variation in the trend on the part of live car dealers to look to their individual shops as real profit opportunities, capable of aiding materially in establishing them as permanent, foul-or-fair-weather automotive merchants in their communities. Among the dealers who are getting this constructive vision of their service opportunities are scores who will be outstanding in car selling as well.

The question isn't one of divided effort. The man who runs a profit-making service station today is very likely to be a better car merchant than the illogical chap who loses money in his shop.

* * *

Must Dealer Profit Standards be Changed?

THE vice-president of one of our most successful passenger car companies during New York Show week expounded to us some ideas about dealer profits so striking that we have been pondering them ever since. Frankly we've been trying to make up our mind as to just how much there is in this set of ideas—and, naturally, have been trying to figure out a way to work them into some article or other.

Thus far we still haven't gotten out of the pondering stage; but we can't stop thinking about the ideas. Since they have stuck in our mind so vividly all these weeks, there would seem to be a good chance that some of our readers would be interested just in reading the point of view expressed by this factory executive.

Working on that theory, we present the following paragraphs—just as the elucidation of an interesting point of view. Perhaps it might be entitled "Must Dealer Standards of Profit in the Automobile Business Be Changed?" Here are the ideas as we remember them:

"Back in the old days when the going was easy, factories, in trying to get new blood and new capital into dealerships, talked vigorously and truthfully about the large profits to be made. There were attracted into the business scores of men who were used to earning for themselves anywhere from $10,000 to $20,000 a year; men who were executives; men who operated organizations which needed executives and executive supervision even though those organizations were located in relatively small towns.

"To men of this character personal operations of details was and is distasteful. Earnings of $2,500 to $5,000 a year seem small. Profit possibilities of this kind seem picayune to them and leave them without enthusiasm for the business.

"And yet when we take a look at government statistics we find that nearly 80 per cent of all the people in the United States making income tax returns earn less than $5,000 a year.

"That means that there are literally thousands of capable, sincere, energetic men all over the country to whom a business offering $5,000 a year net return would mean increased income, increased opportunities and a real inspiration. This group consists largely of men who wouldn't know what to do with their time were they compelled to sit behind a desk and try to be executives.

"Automatically, such a man would function as his own sales manager if he had a car or truck dealership. Automatically he would participate personally in the daily detailed activity of his organization. *AUTOMATICALLY HIS OVERHEAD WOULD BE LOW.* It wouldn't have to be cut, because it never would have been high.

* * *

Selling Automobiles a Job—Not an Executive Position

"FACTORY field men, in many cases, still are going about the country talking about big profits and wonderful opportunities in the automobile retail field. In an effort to get into their fold a certain type of man they still are talking $20,000 possibilities in connection with dealerships whose real possibilities are $5,000 with the owner a worker himself and not a part of overhead.

"Overproduction and forcing of cars on dealers by factories unquestionably has been responsible for putting out of business scores of automotive retailers in the last few years. But the attempt to maintain an organization suitable for a $20,000 profit business in a $5,000 profit market has been responsible for more.

"From here on, the business of selling automobiles at retail in the average town of 50,000 population or less is going to be a job, not an executive position. The automobile retailer will have his choice of trying to maintain his dignity as a member of a decadent aristocracy of retailing or of taking off his coat and joining the really dignified army of American workers."

Does this executive overstate the case? Is he right or wrong? Or a little bit of both?

What do you think?—N.G.S.

Accurate Machining Most Import

Large scale production requires care
ing must be done within close
finished unit must with

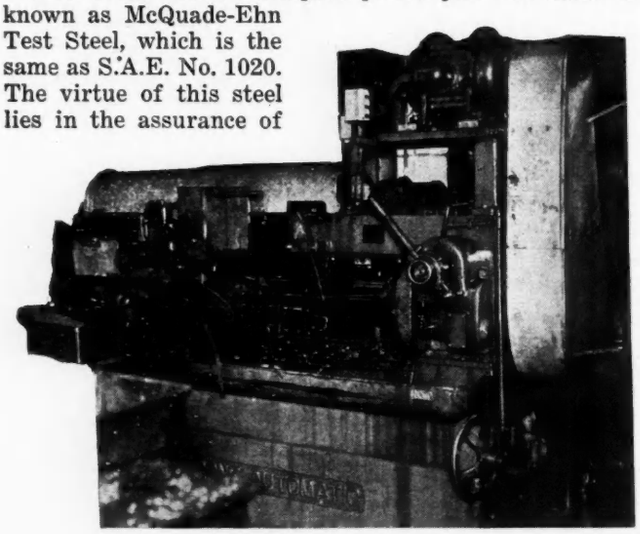
By E. A.
Factory Manager,

IN the large scale manufacturing of wrist pins, proper heat treatment of the steel used and the holding to close limits of accuracy during machining and grinding operations are the most important considerations.

It is obvious, too, that the wrist pin must be of maximum strength transversely and hard enough to withstand tremendous bearing wear. By suitable heat treatment, the steel, whatever type it may be, is rendered in such a condition that it offers maximum fatigue resistance. This is an important item in reducing weight to a minimum.

The necessity of accuracy in machining is obvious. Large scale production falls down completely if parts are not interchangeable, and all Thompson pins, as well as being held to close limits, are marketed in balanced sets.

Steel from which Thompson piston pins are made is known as McQuade-Ehn Test Steel, which is the same as S.A.E. No. 1020. The virtue of this steel lies in the assurance of a uniform acceptability to carburization. It is free from surface defects and has a low carbon content, which means that the uncarburized portion will be tough and shock resisting.



A Cone Automatic is used in the first operation. The machine cuts the blanks to the proper length, at the same time forming a radius on each end

Pins with a very thin wall section are made from nickel chrome alloy steels, the general practice being to follow the steel specifications recommended by the manufacturer of the motor car.

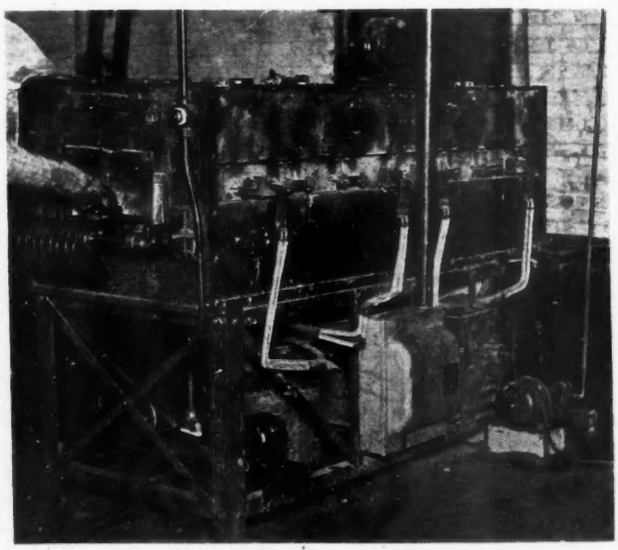
As the first manufacturing operation, bars of steel, 1/64 in. or 1/32 in. over the normal size of the pin, are placed in a Cone Automatic Cut-off machine. This accurately cuts the pins to length, at the same time forming a radius on each end.

The steel is then a blank of the finished length of the pin and from 1/64 in. to 1/32 in. over the finished diameter. This is placed in a carburizing furnace and the temperature raised above the critical point of the metal. Here a carburizing gas is introduced, and due to the action of carbon monoxide and volatile hydrocarbons which deposit carbon in areas near the surface, a case is formed of the approximate analysis of tool steel. This results in a hardened surface which will well withstand wear. The fact that gas displaces all air in the furnace insures against scarring or oxidation of the blank.

Special study has been made of this phase of heat treating, and the process has been so developed as to produce a case which shows a gradual decrease in carbon content from the outer surface to the core, without enfoliage or blistering.

The blanks are then dumped into a container and allowed to cool slowly so as to secure a uniform grain structure with no interior strains. Next they are inserted in the hopper of a four-spindle Cone Automatic Screw machine. These machines automatically place one blank after another in the spindles, after which the working tools, or drills, come into position, drilling the center of the blank half way through. If the pin has a taper hole, a taper reamer follows the last drill, reaming the hole to the desired shape at the same time. The pin is then rejected automatically and placed in the hopper again for the same operation to be performed on the other end.

When a pin is small or of simple design, the interior chamfer is cut during the same operation. On larger



In the manufacture of Thompson wrist pins the Hoskins electric furnace is used for refining the core and hardening the case of the pins

ant in Manufacture *of Wrist Pins*

in heat treatment. Milling and grind-limits, with rigid inspection, as stand tremendous wear.

McBRIDE
Thompson Products, Inc.

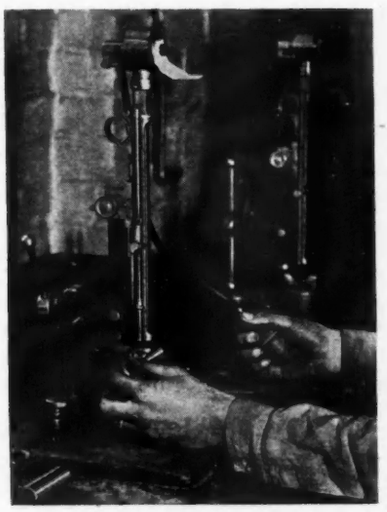
pins, however, requiring many drilling positions, the chamfer is put in with a Murchey tube and pipe nipple machine. This grips the pin in the center while tools operate at both ends of the pin simultaneously, moving about as the pin remains stationary. The operations mentioned thus far are watched very closely to insure meeting the car manufacturer's specifications exactly. Taper holes are checked with gages, and weights are compared with master pins.

Milling the center slot, if there be one, is the final machining operation. This is done on a milling machine with a rotary table, whereon each pin passes successively under the milling cutter, resulting in a slot of uniform depth. Particular pains are taken to make sure slots are located in the center of the pin, so that when placed in operation both ends will be at uniform distance from the cylinder walls.

In the lapping operation, great accuracy is required. In the view above, the pins are being placed in a Norton lapping machine, with the disk removed

Pins of other types having set-screw holes are drilled in accurate jigs on Kingsbury Automatic drill presses. Very close inspection on hole diameter and location is necessary to assure free-fitting set screws and proper location of the pin in final assembling.

The pins are now ready for final heat treating, which consists first of a high heat operation to refine the structure of the core, or soft portion, of the pin. This is very important if the desired strength in shock-resisting qualities are to be imparted to the pin.



Scleroscope tests for hardness are made in three places on the pins, and rechecked for diameter, roundness and taper on amplifying gages

The next treatment is at low heat, after which the pins are quenched to give maximum external hardness to the steel. This hardness is checked and must show a scleroscope reading of 75 to 85. In the final heat treatment the pins are immersed in oil of proper temperature for an hour to relieve strains in the hardened exterior and insure against enfoliation or blistering.

For roughing and semi-finishing the pins, a Cincinnati centerless grinder is used

These heat treatments produce a slight formation of scale inside the hole of the pin, and to prevent this accumulation loosening at some future time the pins are sand-blasted on a Sly Rotary Mill. This removes every vestige of scale from the interior.

The pins next go to a Cincinnati centerless grinder, where numerous passes are made, assuring roundness, uniformity and freedom from taper. During the grinding the pins are held to two-tenths of one-thousandth.

Following the grinders the pins are lapped between side surfaces of wheels of very fine texture. The amount of stock to be removed is gaged by the number of minutes the piece is lapped. An idea of the accuracy possible with these machines is gained from the fact that it requires 1 min. to remove 0.0001 of an in. The lapping produces a mirror-like surface, eliminating high spots and feathery surface. This also supplies the customer with a pin which is already broken in.

They are then rechecked for hardness by scleroscope readings in three places, and for diameter, roundness and taper on amplifying gages reading in fractions of 0.001 in.

If there is any slight variation apparent, the pins are sorted in sets so that no pin in any set varies more than a tenth of a thousandth from the others. They are then immersed in a rust-preventing solution, wrapped in wax paper, and packed in metal boxes.

Automatic Machines *for Welding Increasing*, Report Shows

Wider use of non-destructive methods of testing, and development of new composition rods, cited by American Welding Association as high points of 1929

THE following brief review of welding developments during 1929, of interest to the automotive field, was prepared by a committee of the American Welding Society. Attention is called to the fundamental studies in the welding field by at least ten prominent universities aimed at increasing our knowledge of the fundamentals of welding. Among the general developments may be mentioned a code prepared by the American Welding Society on "Fusion Welding and Gas Cutting in Building Construction," and a report on "Nomenclature, Definitions and Symbols."

"Another year of experience with welded structures of all kinds including piping, pressure vessels and other equipment subjected to severe service, has created widespread confidence in fusion welding and made its acceptance among engineers more general than ever. This has been reflected in increased volume of business in materials and supplies for welding.

"The aircraft welding committee of the American Welding Society is completing its work. The Bureau of Standards has conducted an investigation of welded joints for aircraft construction in cooperation with the oxy-acetylene industry and the latter has adopted a definite program of cooperation with aircraft manufacturers for the purpose of improving present standards.

"Non-destructive methods of testing have reached the stage where they may be applied in a routine manner. One test of this type is the stethoscopic method which can be applied to practically all welds, and is important because it provides a portable means for examining completed welds. By a new X-ray testing procedure, the tensile strength of any section of a weld can be estimated to within 3000 lb. per sq. in. The latter is at present a laboratory method, but may be made portable in the future. Electrical resistance testing has proved very successful for small cross-sections. Magnetic testing shows promise, but is as yet only experimental.

New Welding Rods

"Steel welding rods of new composition have been developed which easily produce full-strength welds in the stronger materials lately introduced, such as steel line pipe of increased carbon content. High-strength bronze welding rods also have been introduced with marked success and are increasing the application of the versatile bronze-welding process. These welding rods are among the products of the extensive research laboratories, supported by the industry, which are constantly contributing to the advancement of welding through pure and applied research. Oxy-acetylene shape-cutting machines are finding increased application in the economical forming of steel plate and heavy sections.

"One of the outstanding developments during the past year is the large increase of the semi-automatic and the completely automatic types of resistance welding machines. With semi-automatic or automatic machines production can be doubled and quadrupled per man per welder as compared with hand-operated machines. This change has been accompanied by the use of large welders even on small jobs. At the present time most of the welders sold are of 150 KVA rating or greater, yet some of them weld a cross-section of only about 0.75 sq. in., but they do it rapidly because the amount of power required is inversely proportional to the welding time. Many parts of automobiles, trucks, tractors, farm machinery, etc., which were formerly made from drop forgings or steel castings, are now being made from stampings or drawings and welded together.

Cutting-Off Machines

"During the last year or two the practice of using the small resistance welder for a cutting-off machine has become common. This is especially true in the severing of stranded steel cables for various uses, particularly four-wheel brakes on automobiles and trucks. This method is also used for cutting off stranded wire for the inside rims or clinchers of automobile and truck tires. Formerly, when it was desired to cut this stranded cable in two, it was necessary to first solder a thimble, cut through it and then remove it. By means of this electric cutting-off process no thimbles are required, as the wires are all fused together into a solid lump which will not unravel. Relatively large cross-sections of copper strips and bars are now welded by the resistance process by means of especially designed copper welders. Until recently, bars about ¼ in. to ⅜ in. diameter were the largest work that could be satisfactorily done by this process. Another development is the use of the resistance welder for precision work on parts such as reamers, cutters, drills, dies and many other fine tool jobs.

"Although projection welding is an old idea, it was not used much until the last two or three years. Now, however, it is being adapted for many new and novel purposes in many industries, but more especially in the automotive industries.

"One thing that held back the general adoption of projection welding for many years was the fact that there was no suitable material for dies that would stand up, particularly when a number of projections were made at the same point of the die. Now there are two or three materials that will stand up much longer and lend themselves quite well to the process. Foremost among these materials is an alloy consisting largely of copper, tungsten and other elements in small quantities."

Definition of Natural Gasoline is Based on Two *Major Factors*

Temperature and vapor pressure are fundamentals of the criterion determined in the tests made by the Bureau of Standards in conjunction with the Natural Gas Association.

PRODUCERS of gasoline from natural gas some time ago felt a need for a more exact method of determining the amount of gasoline in natural gas than the methods then in use. Of these latter, three deserve mention, namely, the compression-cooling method, the oil-absorption method and the charcoal adsorption method. There are many variations of these methods, since individual operators often introduce modifications to better adapt the method to their own particular conditions. As a consequence it is difficult to obtain agreement between tests made by different parties.

Realizing the above unsatisfactory state of affairs, the Natural Gas Association of America appointed a committee to study the problem and to formulate a standard method of test. This committee made an investigation which led to a partial and tentative standardization of the three methods mentioned, and a critical study of their accuracy. The experimental work in connection with this investigation was carried out at the Bureau of Standards, and a report on it, by Martin Shepard, associate chemist of the bureau, has just been published as Research Paper No. 75.

It was found early in the investigation that a reference, or umpire method, was needed for the determination of natural gasoline. In the research paper mentioned such a reference method is described. The equipment required is relatively complicated and makes its use unsuitable for routine field testing or ordinary plant control. It is of particular value when new processes are to be investigated or actual plant efficiencies to be determined. It may be used to study and standardize ordinary methods of plant control or resorted to in case of umpire decisions involving questions of the true gasoline content of natural gases.

It is pointed out in the report that in order to develop a method for the quantitative determination of some one substance in a mixture of other substances, it is necessary to clearly define the nature of the particular substance to be determined. Strangely enough, this usually simple requirement presented considerable difficulty in the case in hand, for the natural gas industry has never reached a definite agreement on just what is meant by the term "natural gasoline."

It is generally agreed that natural gasoline consists of a mixture of hydrocarbons which may be condensed from natural gas, and that this condensate should be commercially manageable; that is, capable of safe transportation from the point where it is produced to the point of its utilization, which is generally a refinery where it is blended with refinery or cracked gasoline. But just what the exact chemical composition of this condensate may be is a question that cannot be answered. This is due both to the different characters of the natural gases from different fields and to the difference in local requirements of refiners. Seasonal temperature changes also conspire to confuse the identity of the substance which must be determined.

As a result of the work of the committee, a definition based on the two factors of temperature and vapor pressure has been evolved and the reasoning on which this is based is given as follows in the report:

"Vapor pressure becomes one criterion, since present Interstate Commerce Commission shipping regulations are formulated with respect to this property. With an arbitrary classification of petroleum condensates once established on such a basis, the producer of natural gasolines must then be directly concerned with the vapor pressure of his product.

"On the other hand, it is obviously possible to produce hydrocarbon condensates of an infinite variety of percentage compositions, all of which may possess an identical vapor pressure at some fixed temperature.

Natural gas is composed largely of the saturated hydrocarbons, of which the proportion ordinarily making up the condensate called 'natural gasoline' is of the order of magnitude of 1 or 2 per cent of the total gas. The vapor pressures of these components at once establish the fact that pentane and other hydrocarbons of the series of higher boiling points may be safely included as properly belonging to the condensate to be called natural gasoline. The further fact is evident that some butane may be included in such a mixture without exceeding the vapor pressure requirements. In practice small percentages of propane or even ethane are actually held in solution with the desirable components, although present developments in 'stabilization,' which include the use of a simple rectifying column, are tending to correct this error. It is apparent that small traces of propane will appreciably increase the saturation pressure of such a mixture and cause inexcusable 'weathering' losses.

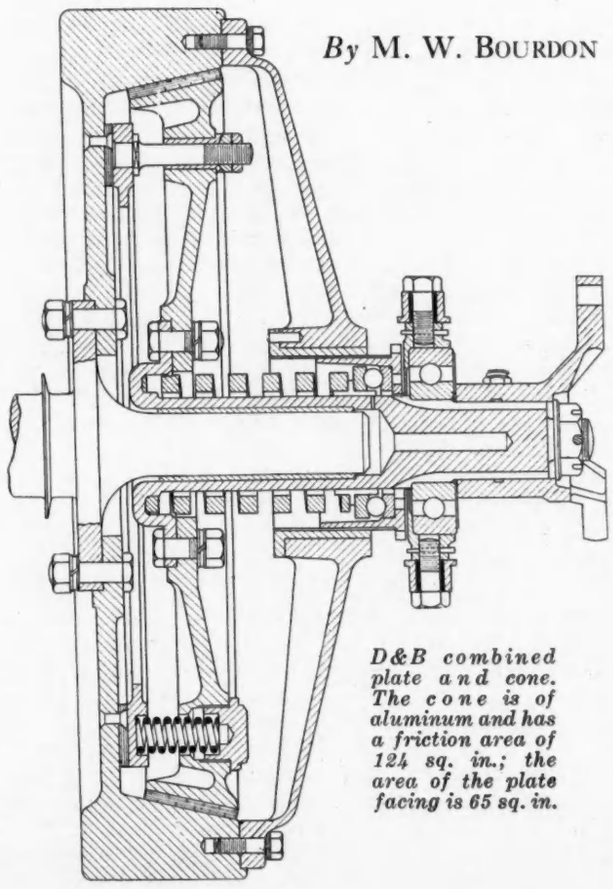
"From this simple consideration of vapor pressures it follows that for any one natural gas of definite composition there is a definite maximum amount of condensate, possessing a fixed vapor pressure (p) at some fixed temperature (T), which can be extracted from this gas, and that when this maximum yield is obtained the composition of the condensate is perfectly definite. The percentage composition and volume of this maximum amount of condensate will depend entirely on the original composition of the gas and the arbitrary saturation pressure and temperature selected. In the case of a 'natural gasoline' this condensate will contain all of the pentane and hydrocarbons of higher boiling points occurring in the original gas and, in addition, as much normal butane as may be incorporated without exceeding the fixed vapor pressure (p) at the temperature (T). It will include no isobutane, propane, or hydrocarbons of lower boiling points.

"Accepting this concept as a reasonable basis of identification, we may then define the natural gasoline content as the hydrocarbon condensate derived from natural gas which is composed of the total percentages of pentane plus higher boiling hydrocarbons occurring as vapors in the natural gas, plus a sufficient percentage of normal butane to cause the total condensate to possess a saturation pressure (p) at a temperature (T)."

Research Paper No. 75 describes a method which may be used to determine this natural gasoline content. No attempt is made to assign definite values to (p) and (T), this being left to the judgment of the industry. In the experimental work on which the report is based, (p) was determined over a relatively wide range with (T) kept constant, so that it is possible to compute the amount of this maximum condensate possessing any convenient saturation pressure. These data are useful in connection with blending and other special problems of the industry. Further, (p) may be determined for various values of (T). In the report the value of 100 deg. F. was used for (T), being selected with regard to shipping regulations. If the corresponding limiting figure of 10 lbs./in. is accepted for vapor tension, the amounts of "natural gasoline," and those of "casinghead gasoline" (not over 20 lbs./in. at 100 deg. F.) and "liquefied petroleum gas" (over 20 lbs./in. at 100 deg. F.) may be expressed in definite figures.

Two-Stage Clutch Adopted by British Truck Maker

By M. W. BOURDON



D&B combined plate and cone. The cone is of aluminum and has a friction area of 124 sq. in.; the area of the plate facing is 65 sq. in.

THE makers of Karrier trucks and buses, Huddersfield, England, have adopted the D&B combined plate and cone clutch which they manufacture under license from the patentee. The accompanying drawing shows the clutch as designed for use with a six-cylinder 4 x 5½ in. bus engine and a four-cylinder 5 x 6 in. truck engine.

The action of the clutch is as follows: When the pedal is released the plate section engages first and will transmit the torque required for normal acceleration. Full release of the pedal permits the cone section to engage, when the maximum torque of the engine can be transmitted when required.

In practice this clutch is astonishingly smooth in engagement, not only when the pedal is released in two stages, or in one in the ordinary manner, but also if the pedal is released "with a bang."

One reason which is said to account for the smooth engagement is that the plate section when engaged acts as a guide for the cone, even though errors exist owing, for instance, to slack fitting or wear of the pilot bearing. It is claimed therefore that there are no fine limits to be observed in manufacturing this clutch.

The following details of the model shown in the drawing are of interest. The cone is allowed approximately 3/32 in. withdrawal movement, axially, before the plates commence to separate; during that movement the spring pressure on the plate is progressively reduced owing to these springs having the cone as an abutment. There are three driving pins between driven plate and cone, and six springs with a total capacity of 300 lb.; the main spring has a capacity of 610 lb. when the clutch is fully engaged. A clutch brake is fitted to facilitate changing into a higher gear.

Rolled Shapes of Aluminum Alloys Now Being Produced

Application of light metal to the manufacture of truck, bus and railcar bodies, where weight is of importance, is possible. Expected to compete with steel.

By P. M. HELDT

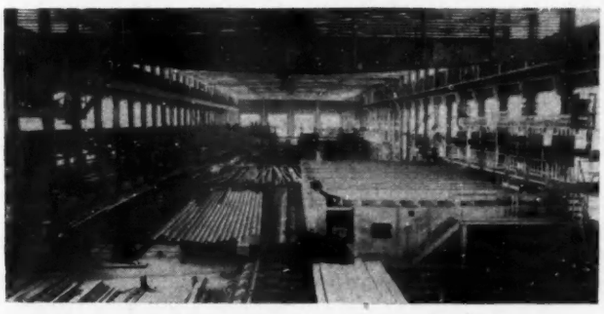
UP to the present aluminum alloys have been used in the form of castings, drop-forgings, rolled sheets, drawn wire, and extruded tubes and shapes. The light metal is now available also in the form of rolled shapes, such as angles, channels and Z-bars, and is expected to enter into competition with rolled steel where a saving of weight is of considerable economic importance.

These rolled shapes are being produced in a new blooming and structural mill at the plant of the United States Aluminum Co. at Massena, N. Y. The fabricating plant in which these shapes are produced consists of three production units, namely, the melting and ingot casting unit, the blooming mill and the structural-shape rolling unit. The structural mill with its auxiliary equipment occupies a single building 900 ft. long by 95 ft. wide. This is said to be the first mill for the production of structural shapes of aluminum alloy in America and the largest in the world.

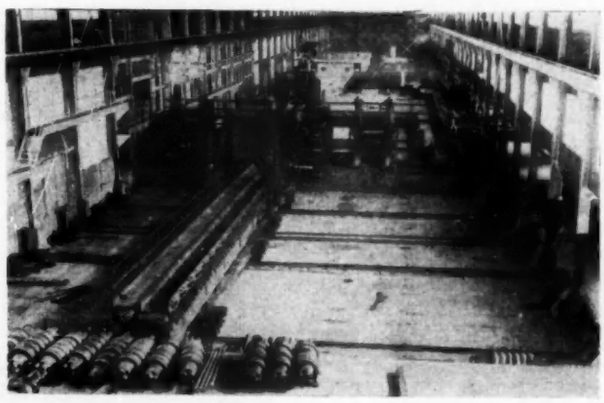
At Massena the aluminum is produced directly from the ores which are shipped there in a refined state from East St. Louis, Ill. The bauxite from which aluminum is produced comes from South America, and in East St. Louis is refined by eliminating impurities constituting about 40 per cent of the total weight. For rolling purposes the aluminum is cast in ingots of as large as 3000 lb.

The equipment used for rolling the shapes is, of course, quite similar to that employed in steel rolling mills. Previous to rolling, the aluminum is brought up to the proper temperature (between 850 and 950 deg. Fahr.). First the ingots are rolled down to billets in the blooming mill and the billets are then further rolled down in the structural shapes mill. The structural mill is driven by a 2000-hp. 600-volt variable-speed electric motor. Most of the current used in the plant is generated on the spot by water power from the St. Lawrence River, the water being diverted by a canal some three miles long and then discharged into the Grasse River, a tributary of the St. Lawrence.

The square billets rolled in the blooming mill are transported to the structural rolling mill by a narrow-gage railroad. In the structural mill the stock is first put through the billet heating furnace, which is of the oil-fired conveyor type, the stock being charged at one end and removed at the other by an automatic unloader which lifts the billet from the furnace conveyor and places it on the power-driven roller table connecting the furnace with the traveling tilt table serving the mill.



Structural shapes made of aluminum alloy on a table conveyor ready for delivery. Note the 10-ton overhead crane



Interior of the United States Aluminum Co. structural mill at Massena, N. Y.

After being reduced to the final section by succeeding passes through the structural rolling mill, the shapes are heat treated in an electrically heated furnace which is said to be the largest of its kind in the world. The length of this furnace is such that structural sections 90 ft. in length can be heat treated. The stock enters the furnace on a mechanically-operated carrier and is picked up inside the furnace by means of lift fingers that lift and carry it across the furnace until it reaches the discharge table on the opposite side. The furnace is divided into 26 zones, and in each zone the temperature is controlled by means of an automatic regulator. Pyrometric equipment is installed to indicate and record the

temperature in each zone of the furnace, the temperature variation being limited to 10 deg. Fahr. The piece is discharged from the furnace by means of power-operated roller table and is automatically quenched as it leaves the furnace in high-pressure water sprays. The piece then passes to a transfer conveyor bringing it to the line of roller tables immediately adjacent to the furnace, where it is straightened. By means of another transfer it is then conveyed to a roller conveyor line where it is cut to length and weighed.

Certain high-strength alloys must be tempered or aged after heat treatment, for which purpose a steam-heated aging oven has been installed, this also taking 90-ft. lengths of the shapes. Recording pyrometers permit close control of temperatures throughout the heating zone. The air in the ovens is circulated by means of overhead fans, to insure rapid and uniform heating. For handling structural shapes in and out of the aging oven, use is made of standard gage railroad-type cars.

At the end of the structural mill building space is provided for carrying a large stock of all structural sections. Special sawing equipment is available for cutting the sections to any desired length. All sections produced are immediately ready for shipment.

At the present time the mill is equipped to roll 10-in. ship channels, 8-in. structural channels, 6 by 4-in. and 5 by 3½-in. angles, and 4-in. Z-bars. The thickness of the section of the channels and angles can be varied. The United States Aluminum Co. is at present working on a book of structural shapes in aluminum which will correspond to similar books dealing with steel structural shapes. Several different alloys are used in the structural shapes. With the material normally used, a tensile strength of between 45,000 and 50,000 lb. per sq. in. is obtained in the shapes. A somewhat larger section is needed with aluminum than with steel shapes for the same loads, but the specific gravity of steel is two one-half times that of aluminum and it is calculated that the weight of members can be substantially cut in half by the use of the new material.

It appears that the field which the owners of the mill had in mind chiefly when preparing for the production of these rolled shapes is that of railway rolling stock. The Pennsylvania Railroad has had in operation for two years an experimental train consisting of nine cars, in the construction of which aluminum alloy structural members were largely used. This nine-car train is said to be equal in operating efficiency to an eight-car train of normal construction.

In traveling cranes the light structural shapes also appear to have a fertile field. A 10-ton crane at the structural mill described has girders made of the light shapes and weighs decidedly less than a standard steel crane of the same load capacity. The initial cost, of course, is greater with the light shapes, but it is argued that this is quickly offset by economies in operation. One question that may arise in the mind of the designing engineer, when contemplating the use of these light shapes, is that of deflection, since aluminum has a modulus of rigidity of only 12,500,000, as compared with one of 30,000,000 for steel, but it is stated that the crane, mentioned previously, which has a 72-ft. span, deflected imperceptibly when subjected to a 17-ton load.

In the automotive industry the structural shapes are likely to find application in the production of bus and truck bodies, as well as of railcar bodies. There would seem to be a possibility also of the use of the channels for truck and bus chassis frames, but in this field they would have to compete with pressed steel rather than with rolled steel, which is no longer being used for frames to any extent.

Twin Coach Delivery Unit

TWIN COACH CORP., Kent, Ohio, makers of buses, are offering a delivery unit for house-to-house service. Although it has but one engine, instead of two which characterize Twin Coach buses, it embodies integral chassis and frame construction and other features of the buses.

The new unit is the result of study of frequent stop delivery service by Frank R. and William B. Fageol.

Body and frame form a single assembly, to which the axles are attached and in which the engine and transmission unit is mounted in rubber. The four-cylinder 3½ by 4¼-in. engine which was designed for this truck, is placed in the forward compartment with radiator flush with front of the body. Service brakes are four-wheel hydraulic and an external transmission hand brake is provided.

Main body sills are 2½-in. channels placed crosswise. Body posts are 1½-in. tee irons covered with 16-gage sheet steel to lower window edge and 18-gage above windows.

Low floor of center section of the Twin Coach delivery unit permits driver to step directly to floor. Front and rear overhang provide additional loading space on the short wheelbase

Two doors are provided, one on each side directly in back of front wheels, either sliding or folding two-piece type. A rear door, 30 in. wide, is available if desired. Floor space is divided into three sections differing in height and length but of a uniform width of 61 in.

Both clutch and service brakes are interconnected and they may be operated either by foot or hand. These brakes are of same design as those in Twin Coach buses and embody American Brakeblok liners and cast gun-iron drums.

Front and rear springs are same size and tires are 30 by 6 in. all around.

To adapt the vehicle to varying local requirements several options are available.

THE FORUM

Indicator Cards Taken on the Road

Editor, AUTOMOTIVE INDUSTRIES:

Recently, upon my return from a three months' study trip in Europe, I looked up the references which Mr. Jacklin mentions in his letter in the Sept. 28 issue of your esteemed journal in support of his claim of priority in indicating automobile engines while in actual operation on the road.

I have found in these articles:

(1) two photos (S.A.E. Journal, June, 1926, and *Automotive Industries*, June 10, 1926), showing the indicating outfit mounted on a car, and

(2) a remark in the "Just Among Ourselves" column of *Automotive Industries* of June 10 to the effect that Professor Jacklin has demonstrated his indicator in a moving car, the diagrams obtained showing considerable variations in the early part of the power stroke.

I have been unable to find, however, what would have been a conclusive proof, namely, an actual diagram taken on the road, with quantitative data (r.p.m., max. pressure, m.e.p.), derived from them.

From these I have to draw the deduction that the indicating tests referred to by Mr. Jacklin were not actual quantitative tests on the engine while propelling the car (and this was the sense in which I used the term "indicating a car engine in motion"), but rather an attempt to demonstrate the indicator as such.

K. J. DE JUHASZ,
Assistant Professor Research Engineering,
Pennsylvania State College.

Indicator Types Differ

Editor, AUTOMOTIVE INDUSTRIES:

The diagrams taken with my indicator in 1926 at the summer meeting of the Society of Automotive Engineers were taken in a study of distribution and were disclosed at the Saranac Inn meeting last June. The diagrams and others have since appeared in the Journal of the Society.

Apparently, the whole matter has come down to a discussion between Mr. De Juhasz and myself. We have been working independently of one another in the development of two distinct types of high-speed indicator. Inasmuch as we find variations in cylinder performance as great as disclosed in the above mentioned paper, the writer is convinced that the taking of diagrams on a single cylinder is insufficient. My experience has been that long tubes make for great inaccuracies, consequently I have deemed it necessary to get as close to the cylinders as possible irrespective of whether the hood on the engine is raised or not.

I have an idea that other experimenters have actually taken diagrams in road tests considerably previous to 1926, and I hope that some reader will have definite information to supply.

H. M. JACKLIN,
Professor of Automotive Engineering,
Purdue University.

Unlined Aluminum Cylinders

Editor, AUTOMOTIVE INDUSTRIES:

In your issue of Nov. 2, last, I read with much interest the article concerning the new Daimler chassis. Mr. Bourdon seems to present as new features that the cylinder block of a Knight engine is made of aluminum alloy, and that the outer sleeve works directly against the aluminum walls of the cylinder without a special lining being interposed.

This construction is not new and was certainly not created by the Daimler Co., and as proof of it I want to recall the description of the Minerva aircraft engine which was published in your issue of Feb. 25, 1926, by W. F. Bradley, your European correspondent, who saw the engine at the Minerva factory in Antwerp, Belgium.

Before coming to the States, I was chief engineer of the aviation department of Minerva Motors in Antwerp. In March, 1924, I started the study of an eight-cylinder sleeve-valve aircraft engine of 175 hp. In this engine I incorporated different features that were new in the development of Knight engines, and for which patent applications were filed by Minerva Motors Co.

Cylinder heads were made of aluminum alloy and designed for the installation of two spark plugs. I improved the cooling system of the cylinder to make possible the use of higher compression. The cylinder block was cast in alpax (an aluminum-silicon alloy). The inner sleeve was made of chrome-nickel steel, and the outer sleeve of special bronze.

With this engine we made very long bench tests and later flight tests. The combination of an inner sleeve of chrome-nickel steel, an outer sleeve of forged aluminum bronze, and a cylinder block of aluminum-silicon alloy never gave the slightest trouble.

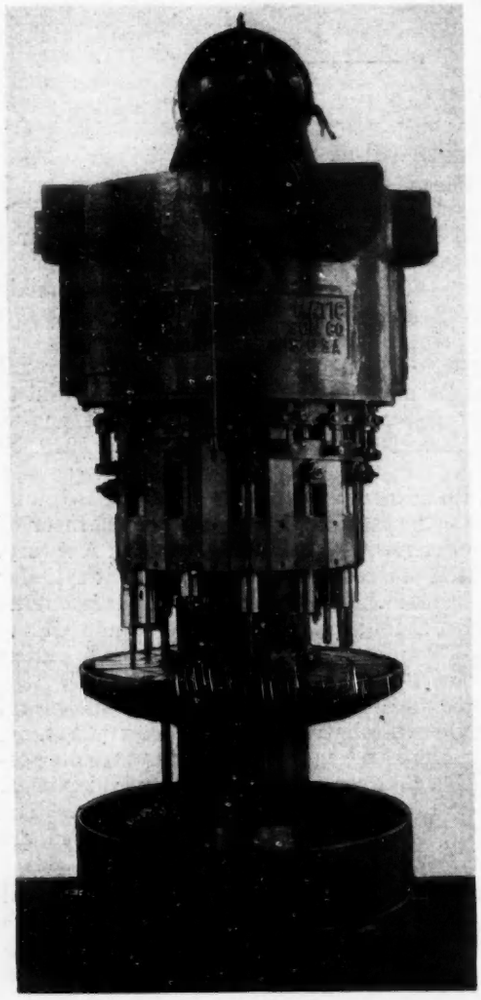
The aluminum bronze had to be very hard, and we had to use forgings in Durville bronze for the outer sleeves to get good results. As Durville metal is very expensive in Belgium, we tried to make the sleeves out of castings made in S.A.E. No. 68 and S.A.E. No. 63 bronze compositions. The bearing qualities of both bronzes against the cylinder walls in Alpax were not satisfactory. The sleeves made out of castings wore off very quickly and gave lubricating troubles around the exhaust ports. Very surprising was the fact that the trouble was always on the sleeve and never on the cylinder walls.

D. J. DESCHAMPS.

NEW DEVELOPMENTS—Automotive

Continuous Drilling Machine

CONTINUOUS drilling of single hole jobs such as foot pedals, spring hangers, connecting rods and similar parts is said to be accomplished with facility on the 12-spindle Davis "Rotomatic" just placed on the market by the Davis and Thompson Company, Milwaukee, Wis. One of the features of the machine is an adjustable cam by means of which the drill may be set to any depth, for example, ¼ in. or 6 in. as the case may be. The spindles are adjustable up and down and have a total movement of 12 in. Each individual table is independently adjustable and the maximum distance between the nose of the spindle and the table is 26 in. The smallest diameter of spindle is 1⅞ in. The shank in the nose of the spindle is usually No. 4 Morse taper. The machine is designed to be operated at a motor speed of 1150 r.p.m. Pick-off gears between the motor and machine enable the spindles to be operated at any desired speed; the range being from 50 r.p.m. to 700 r.p.m.



Davis & Thompson "Rotomatic" continuous drilling machine

The base of the machine serves as the oil pan and lubricant is pumped from this reservoir to an oil pocket in highest part of machine. From this point oil leads run to each bearing and gear, constant oil level being maintained by the pump. Drains from these bearings lead back to reservoir. The spindle gears are supported on double row ball bearings and so arranged that they do not leak oil over to spindles.

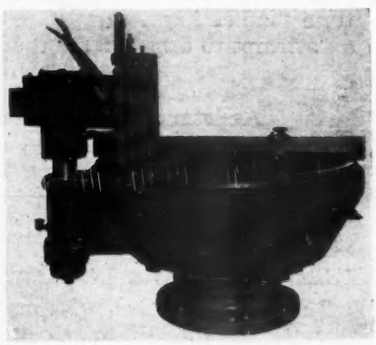
The camming adjustment, as illustrated, shows the cam supported by a number of threaded arms which are clamped to the ring with nuts. These threaded arms are graduated in inches and parts of an inch for accurate adjustment of the spindle. At the highest part of the cam is an angular piece which allows the spindle to return to its traveling position in an easy motion. The spindle rollers, which are ball bearings, travel along the support and advance rapidly to the work in the continuous drilling process. Another feature is the easy removal of spindles, since all that is required is to drop the table and allow the spindle to drop to a desired position. Spindle gears can be readily removed through the inspection door in the upper part of the housing.

The "Rotomatic" is completely equipped with ball bearings. It is full-automatic in action as the operators' sole duty is to load and unload the work at one station. The weight of the machine illustrated is 20,000 lb.

Swinging Work Table

A HAND-OPERATED swinging work table is now available on the No. 24-53 horizontal disk grinder, made by the Gardner Machine Co., Beloit, Wis. The addition of this table makes it possible to produce two surfaces of one casting in accurate relation to each other.

The table pivots on a shaft carried in a bracket fastened to the machine base. The guard ring of the machine is cut out to the extent required by the size of the parts to be ground, making it possible to swing the work table across the cutting member by means of two conveniently located handles. The table is raised from and lowered onto the grinding wheel by means of the locking hand lever, spring tension providing the necessary pressure against the wheel during the grinding operation. When in normal grinding position, the work table forms an accurate 90-deg. angle with the surface of the grinding member.



Gardner No. 24-53 swinging work table

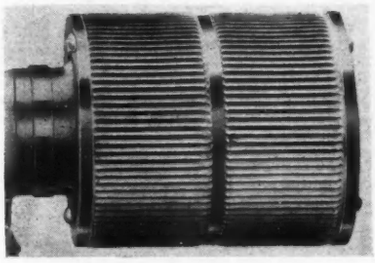
The large working surface of the table, measuring 12 in. by 20 in., makes it capable of handling parts of relatively large size and area. The illustration shows the table mounted on a bracket bolted to a pad cast integrally with the base of a No. 24-53 vertical built-in motor-driven Gardner grinder, but by means of other brackets it may also be applied to machines of this type already in the field. It is also designed for application to the gear-driven No. 24 grinder, in either belt or motor-drive.

Parts, Accessories and Production Tools

The work table has a horizontal adjustment of 8¾ in. and a vertical adjustment of 4 in. Floor space required for the machine shown here is 74 in. by 60 in. Power required for average duty is 20 hp.

Oberdorfer Backfire Trap

A BACKFIRE trap for internal combustion engines has been developed by the M. L. Oberdorfer Brass Company of Syracuse, N. Y. It has been introduced in the marine field and is now being engineered for the automobile and aviation fields.



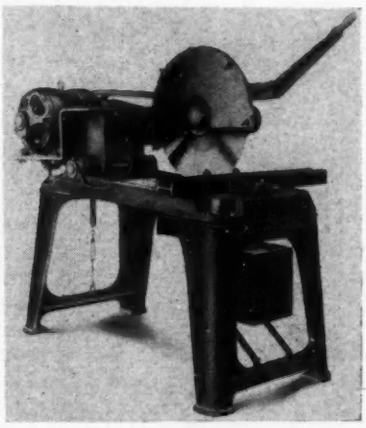
Oberdorfer backfire trap

The device, which is manufactured of non-corrosive materials and is said to be sufficiently strong to readily withstand any pressure due to a backfire, is secured to the carburetor air inlet. It is claimed to act also as an air-cleaner. The trap consists of a number of concentric cylinders. The flame of a backfire enters the innermost of the cylinders and is broken up into a large number of tiny jets. These are then compelled to pass through louvers in the walls of successive cylinders, and in the process the gases are cooled to such an extent that no flame can get out into the atmosphere. The device is said to have received the approval of the Underwriters Laboratories.

High Speed Metal Saw

COLD metal bars and rolled shapes may be cut by means of a circular-toothed saw on the high-speed metal cut-off saw recently introduced by the Hunter Saw & Machine Co., Pittsburgh, Pa.

The motor and saw blade are mounted on opposite ends of a tilting frame. The saw is driven by an endless belt from the motor, and an idler pulley is located in the frame to give maximum belt contact with minimum tension. The saw arbor is mounted on double-row ball bearings and the idler pulley on single-row ball bearings, the bearings being protected in oil-tight, dust-proof housings. The belt and saw blade are protected by steel guards to conform with safety specifications. The belt guard can be quickly removed and the endless belt applied without dismantling other parts of the machine. A pan is attached to under side of table inclosing the saw at its lowest point to catch cuttings; this can be dropped and cuttings removed.



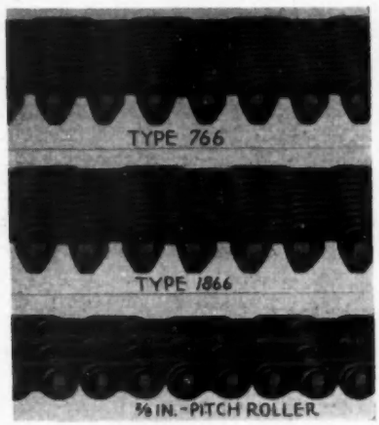
Hunter high-speed metal cut-off saw

The table is provided with a quadrant stop that can be set to any angle within the sweep of the saw blade used. This stop is held firmly in position on the table by bolt moving through T-slots. Material is clamped by quick-acting eccentric vise.

Morse Drive Chains

THREE new chain types for front end drives were announced recently by the Morse Chain Co. of Ithaca, N. Y., and Detroit, Mich. All three are shown in the accompanying illustration.

The type 766 is a toothed chain with a link form which is a development of the Morse constant-pressure-angle-system of tooth engagement, but is symmetrical in shape, which permits of travel in both directions. The joint is made by a round pin and segmental bushing, a construction similar to that found on the Morse B-45. This type of chain is used in several 1930 installations.



Three types of Morse drive chains

The 1866 chain is another new type which has been under development for more than a year. It is said to be very quiet in operation at normal speeds and to possess excellent life. The link form is the same as that of the 766, while the joint consists of a single specially-shaped pin. This type also is used for the front end drive on several 1930 models.

To take advantage of the advantages of the roller chain, viz., light weight and large pin area, the Morse Chain Co. has placed on the market a chain of this type for light service. It has a ⅜-in. pitch and a unique joint construction, embodying the oscillating pin and two segmental bushings. The joint is identical in size with that of the present Morse ½-in. pitch type 1060 chain, which is used for the front end drives of many makes of cars. This chain, which is said to be unusually quiet, is offered for magneto and other light accessories drives.

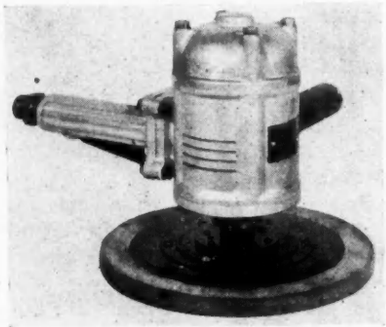
Self-Lubricating Bearing

A SELF-LUBRICATING bronze bearing has just been announced by Johnson Bronze Company, New Castle, Pa., makers of bronze bushings, bronze bearings, bronze castings, cored and solid bar bronze. The new bearing provides for a uniform area of bearing surface on the pressure line, and insures an efficient distribution of lubricating compound. The compound used is also a

Johnson Bronze development. The improved results are obtained by a new method of effecting indentations in the metal and by placing them on an angle of 30 deg. Patent covering this method has been applied for. The bearing is adaptable especially for parts subject to intermittent or periodic operation.

Sander and Cup-Wheel Grinder

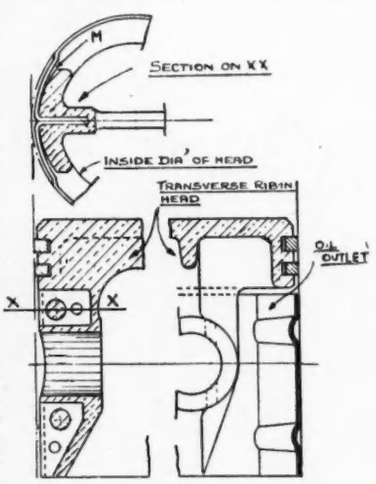
A NEW Hercules pneumatic Sander and Grinder, the No. 362-4, for use with felt pads and abrasive disks or with cup wheels, is announced by the Buckeye Portable Tool Co., of Dayton, Ohio. The new tool is equipped with the Hercules governor, which is said to give a higher speed and more power under load. The air in this tool, as in other Hercules tools with governors, is delivered directly to the rotor, which is a special feature said to make for long-life and trouble-free operation. This machine is also equipped with the Hercules Safety throttle, and an oil reservoir on the dead air handle. The dead air handle is tapered to a hammer handle shape so as to fit the operator's hand more snugly. Both handles are placed close to the center of the tool for maximum grinding pressure without overbalancing it.



Hercules Sander No. 362-4

British Composite Piston

A NEW composite piston known as the Saunders Bimetallic has been developed in England by Philip K. Saunders of Birmingham. The skirt of this piston consists of two stampings which are lightly riveted or spot-welded together as shown in the drawing. When thus joined together the stampings form a substantially cylindrical shell which is slightly recessed near the joints so as to clear the cylinder walls. The "slipper" faces are a few thousandths of an inch proud of the cylinder bore to allow for final grinding. The halves are joined together along their inturned faces and these faces are perforated in various places as shown. The skirt is then placed in the mold and the aluminum is cast onto it. The molten metal completely surrounds the inturned portions and also flows through the holes, and the aluminum in the holes, owing to the high contraction of this metal, gives a riveting effect.



Details of Saunders Bimetallic piston

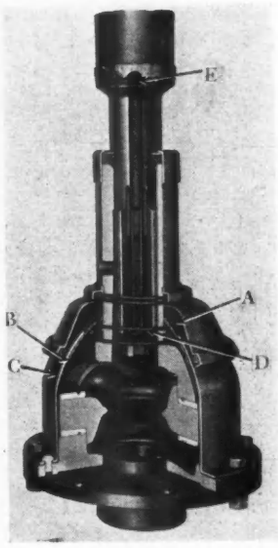
In die casting the cores are whipped out before they are gripped by the contacting metal. After the core is removed the contraction of the aluminum is unrestricted and the arms which carry the piston pin bosses are drawn toward each other, thus distorting the skirt along the joint lines and creating clearances at *M*, which are said to be more than adequate to take care of any subsequent reexpansion.

Universal Joint Seal

THE Spicer Manufacturing Corp., Toledo, Ohio, has perfected a lubricant seal for its well-known type of universal joint which is now offered in production on truck and bus joints, the 400, 500 and 600 sizes. The seal is said to be positive regardless of the amount of lubricant used. Joints incorporating the seal are known as Type I.G.

A molded Bakelite-and-fabric cup or disk *A* prevents lubricant from penetrating the space between the inner and outer casings. The outer edge *B* of this disk, which contacts with the inner wall of the inner casing *C*, not only functions as an oil seal at all times, but during universal action of the joint serves to wipe the lubricant back into the chamber.

With the universal joint rotating, centrifugal force aids in maintaining contact between the disk edge and the inner wall, while when it is stationary the light pressure exerted by a spring *D* encircling the inside flange of the disk maintains this contact.



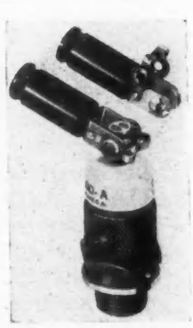
Spicer oil-lubricated universal joint with lubricant seal

To guard against possible damage to the lubricant seal as well as to the inner and outer casings if too much lubricant should be injected by high pressure apparatus, a vent *E* is provided through the center of the shaft to permit escape of excess lubricant. This vent also indicates when the joint is full, by overflowing.

The fundamental design of the joint remains unchanged, the assembly, as a whole, being interchangeable with the former standard. Lubricant is injected through channels in the yoke and shaft ends as formerly.

Spark Plug Cable Terminal

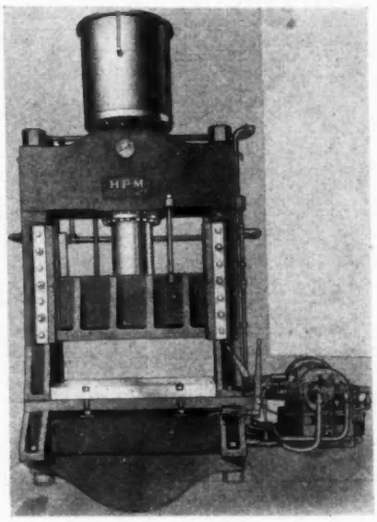
A LOCKING spark plug cable terminal of unique construction has been placed on the market by the Tiffany division of the Connecticut Telephone & Electric Corp. of Meriden, Conn. This new terminal has powerful phosphor bronze spring jaws which make contact with the ball terminal of the spark plug. Then the contact is locked by a hinged bale which swings down across the end of the terminal. It is claimed that the connection is so secure that violent air maneuvers, rough landings, sudden propeller blasts or engine vibration cannot loosen it. Yet, in service, the terminal may be removed as quickly as the ordinary kind. Bakelite dilecto is used for an insulating muff for the cable end.



Connecticut spark plug cable terminal

Hydraulic Power Press

UNIVERSALITY of metal-working operations such as blanking, coining, drawing, etc., combined with a high production rate are said to be available with the new H-P-M Hydro-Power press recently announced by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. This press is made in two standard models, the open side type and the square bed type, in sizes ranging from 150 to 2000 tons pressure.

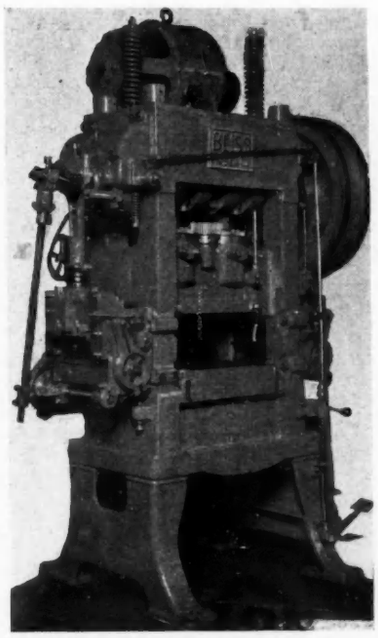


H-P-M Hydro-Power press

The H-P-M press is a self-contained unit and does not require an external source of power or accumulator system. The working fluid is oil which also serves to lubricate working parts. Among the features of this new press are the following: variable stroke with adjustment to suit the work; automatic control of working pressures; remote controls to safeguard the operator; protection against overloading. The operating cycle may be full automatic or semi-automatic as desired by adjusting the controls. The bolster dimensions on the square bed type press range from 24 x 24 in. to 60 x 60 in. and 60 x 36 in. to 216 x 72 in. for the open side type.

Shear Type Scrap Cutter

A NEW scrap shear attachment on all "Bliss" high production presses is announced by the E. W. Bliss Co., Brooklyn, N. Y. The shear slide is driven from an eccentric on the extended crankshaft of the press through a standard ball joint connection. This eccentric is arranged so that the scrap cutter is timed 30 deg. behind the press slide, giving ample time for the pilots to locate the strip before the shear blades lock it. Regular press gibbing is used for the shear slide and take-up screws are provided so that a tight sliding fit can be maintained. The upper shear blade is mounted in an adjustable holder similar in function to the table of a squaring shear, making it possible to obtain the fine clearance between blades required in cutting thin stock. A plate backed by springs holds the stock down tight against the lower blade for efficient cutting. Special shear blades of Neor steel are used to cut the hard silicon steel required for radio, motor and power transformer laminations.



Bliss shear type scrap cutter attachment on high production press

Portable-Adjustable Drill

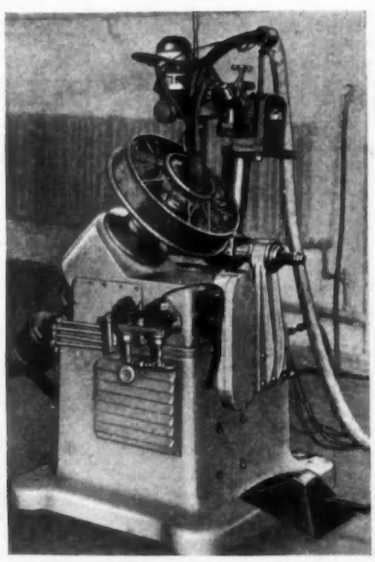
SEVEN inch feed and 1¼ in. diameter drill in steel are said to be within the capacity of the portable pneumatic drill press just announced by the Buckeye Portable Tool Co., Dayton, Ohio. The pedestal has a three leg base, with double wheel rollers in each leg and the base is provided with an oil reservoir having a capacity of one-half gallon. An adjustable needle valve connects the oil reservoir to the air hose just above the throttle and permits the proper amount of oil to pass through the hose to the rotor, insuring ample lubrication of that part for a minimum of two weeks constant operating before refilling the reservoir. Air power is controlled by a foot air throttle, leaving the hands entirely independent of the air control. The maximum elevation of the tool is 45 deg. above the horizontal. The stand may be raised or lowered, maximum height being 44½ in.—minimum 32¾ in. This unit consists of a model 34-3 Hercules pneumatic drill mounted on the portable and adjustable drill stand.

Buckeye portable-adjustable pneumatic drill

Arc-Welding Wire Wheels

AN automatic machine for the manufacture of wire wheels, by the carbon arc-welding process, has been introduced recently by the Kelsey-Hayes Co., Detroit, Mich. The purpose of this machine is to lap-weld the pressed steel parts inside the hub as the wheel turns in a jig. The welding time for an 8-in. hub is 40 seconds, and the floor-to-floor production is 50 per hour.

This machine is equipped with the Electronic Tornado, manufactured by the Lincoln Electric Co., Cleveland, Ohio, and utilizes the carbon arc-welding process. No metal filler rod is necessary as the metal of the hub parts is fused together.



Kelsey-Hayes automatic arc-welder for wire wheels

Automotive Oddities by Pete Keenan